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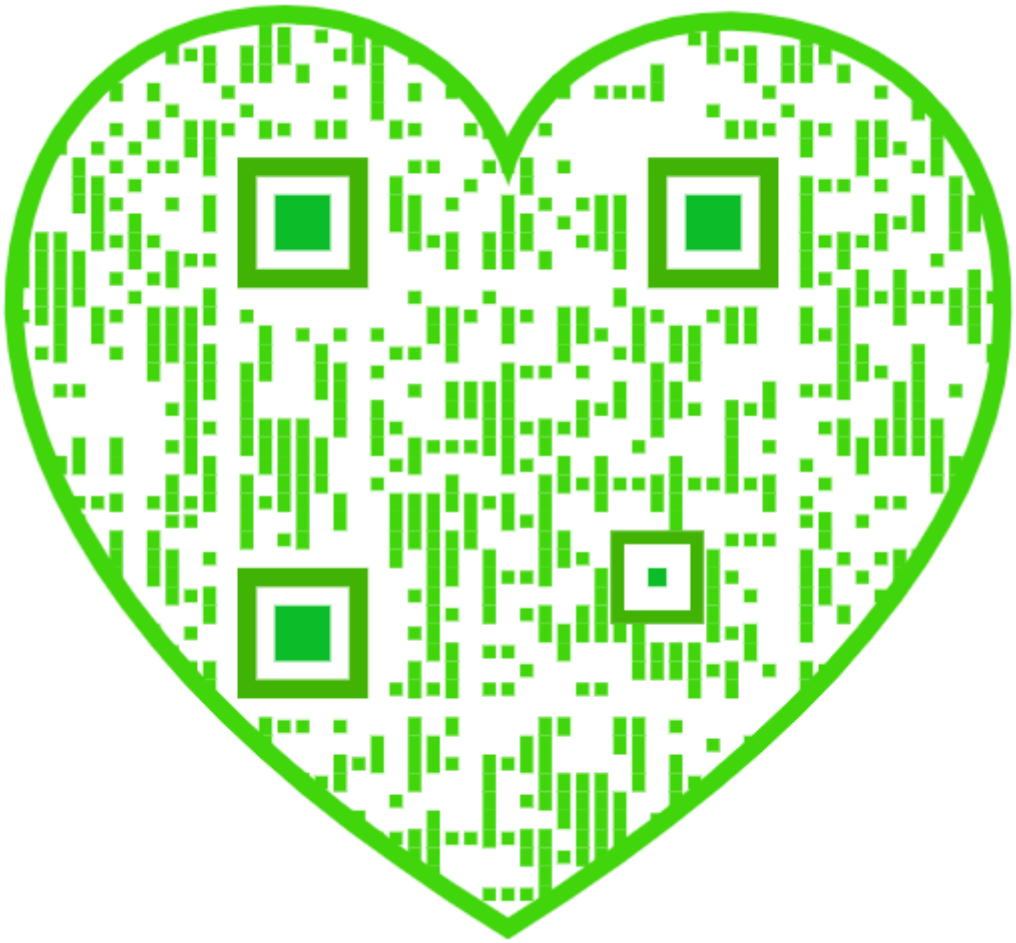

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STATE BOARD OF ENTOMOLOGY

BULLETIN No. 9

VOL. II No. 2

Beekeeping in Tennessee

By G. M. BENTLEY

KNOXVILLE, TENNESSEE
JUNE, 1913

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TENNESSEE STATE BOARD OF ENTOMOLOGY
Bulletin published quarterly at Knoxville
G. M. Bentley, State Entomologist and Plant Pathologist
Entered as second-class matter, February 21, 1912, at the Post Office at Knoxville, Tennessee, nnder the Act of July 16, 1894.

CONTENTS

	Page
Preface	7
Introduction	9
The Life and Habits of the Honey Bee	10
The Queen	11
The Drones	12
The Workers	12
Necessary Equipment	14
The Modern Hive	14
Avoid Expensive and Numerous Supplies	15
Pleasure and Profit in Modern Beekeeping	15
Hive and Bees Affect Yield	16
Hive Parts	16
Full Sheets of Foundation	16
Transferring from the Box or Log Gum to Modern Hives	18
Swarming	19
Methods to Prevent Swarming	20
Italianizing	21
Taking Honey from the Hives	23
Marketing Honey	23
Robbing Among the Bees	24
Remedies	25
Suitable Site for an Apiary	25
Moving Bees	27
Feeding	27
Kinds of Feeders	28
The Sting of the Bee	28
Kinds of Bees	29
Beeswax and Wax Extractor	30
Honey Extractor	31
Chief Sources of Honey in Tennessee	32
Honeydew	32
Present Conditions and Future Possibilities of Beekeeping in Tennessee	34
What the Bees Save Each Year	34
State Aid	35
Tennessee as a Beekeeping State	37
Yield of Different Bees	37
Advantages of Beekeeping in Tennessee	38
Apiary Inspection	38
Report of Apiary Inspection for 1911	39
Report of Apiary Inspection for 1912	39
Exhibition on Agricultural Train	40
Need of Education in Beekeeping	40
Lectures given	40
Report of Diseases	41

Page
The Troubles of the Beekeeper 41
The Bee Moth 41
Wax-Worms 41
White Ants or Termites 43
Ants, Roaches and Spiders 43
Birds 43
American Foul Brood 43
European Foul Brood 43
Pickled Brood 45
Diseases of Adult Bees 45
Sacbrood 46
File a Request for Inspection of Your Bees 48
Apiary Law 49
Supervision of the State Board of Entomology 49
Inspections 49
Authority of Inspector 49
Treatment of Diseased Apiaries 49
Sale of Infected Bees 49
Transfer of Diseased Bees 50
Certificates Required on Bees Coming Into Tennessee 50
Inspection Required of Queen Bees 50
Precautions of Inspector 50
Report of Inspector 50
Salary of Inspector 51
Appropriation to State Board of Entomology 51
Comptroller to Draw Warrant 51
State Beekeeper's Association 51
Instruction in Beekeeping 51
Course in Beekeeping at University of Tennessee 53
Program of State Beekeepers' Association, January, 1913 54
Relation of Beekeeping to Horticulture 56
Beekeeping Terms Explained 60
Firms Handling Bee Supplies and Queens 62
Summary 63
Notice 64
Suggestions on Mailing Specimens 64

LIST OF ILLUSTRATIONS

Spring Inspection of the Apiary.....Cover Page

Map 1. Tennessee Showing Present Survey of Beekeeping Interests 8

Fig. 1. Inmates of the Hive..... 10

" 2. Head and Tongue of the Honey Bee..... 10

" 3. Legs of the Honey Bee..... 10

" 4. Front and Back Wings of the Honey Bee..... 11

" 5. The Digestive System of a Honey Bee..... 11

" 6. The Nervous System of Larva and Adult..... 12

" 7. Heads of Queen, Drone and Worker Bees—View of Wax Glands 12

" 8. Devices for Carrying Pollen..... 13

" 9. Drone Cells Used for Honey Storage..... 13

" 10. A Combination of Worker and Drone Cells..... 13

" 11. Some Reliable Books and Journals on Beekeeping..... 14

" 12. Modern Hive with Exterior Parts Labeled..... 15

" 13. Modern Hives Showing Interior Parts..... 15

" 14. The Hoffman Frame, with Foundation..... 17

" 15. Dazenbaker Brood Frame..... 17

" 16. A Single and Double-walled Hive..... 18

" 17. Double-walled Hive with Top Removed..... 19

" 18. Interchangeable Brood-chamber and Super 2-story Hive with Bee Veil and Smoker..... 20

" 19. A Tennessee Apiary..... 21

" 20. Clipping the Queen's Wings..... 21

" 21. In the Midst of the Honey Flow..... 22

" 22. Exhibition of Products of the Bee..... 23

" 23. The Development of Comb Honey..... 24

" 24. The Orchard As a Site for an Apiary..... 25

" 25. Arrangement of Hives by Twos..... 25

" 26. Never Spray Fruit Trees When in Bloom.....26

" 27. The Boardman Entrance Feeder..... 28

" 28. The Alexander Bottom-board Feeder..... 28

Page

Fig. 29. A Solar Wax Extractor..... 30
" 30. A Honey Extractor..... 31
" 31. Linden or Basswood..... 32
" 32. White Clover..... 33
" 33. Black Locust..... 33
" 34. Asters 33
" 35. Thorn Apple and Apple Bloom..... 33
" 36. Sourwood 33
" 37. Goldenrod 33
" 38. Buckwheat 33
" 39. Plant Lice, the Chief Source of Honeydew..... 32
" 40. Tennessee Honey Exhibit at Tri-State Fair, Memphis..... 34
" 41. Beekeeping with Fruit Growing..... 36
" 42. Natural Comb Building..... 37
" 43. Inspecting the Bees..... 38
" 44. A Compact Apiary on City Lot..... 39
" 45. The Bee Moth and Its Work..... 41
" 46. Comb Showing Advanced Stage of American Foul Brood. 42
" 47. Colonies Infected with Foul Brood..... 44
" 48. Gentle Bees and Close Inspection, Two of the Secrets of Successful Beekeeping..... 48
Map 2. Tennessee Showing Colonies of Honey Bees in the Different Counties of the State..... 52
" 49. Tennessee Beekeepers' Association..... 55
" 51. Perfect Pollenation of Apples..... 56
" 52. Imperfect Pollonation of Apples..... 56
" 53. Perfect Pollenation of Pears..... 57
" 54. Imperfect Pollenation of Pears..... 57
" 55. Bees Carrying Pollen..... 58
" 56. Buckwheat Flowers Showing Floral Parts..... 59

BEEKEEPING IN TENNESSEE

By G M. Bentley

PREFACE

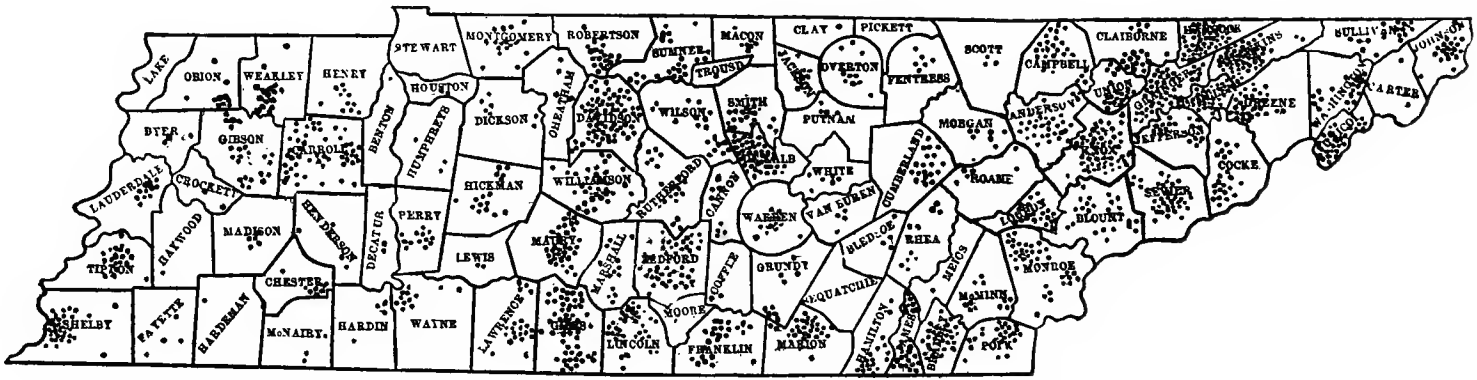
In 1905 the writer began to gather information relative to the beekeeping interests in Tennessee, the chief purposes of which were to learn the possibilities and to get a survey of the industry in all parts of the State. Many apiaries of the State were examined during that year and successive years, up to the present year and some 3,000 apiaries have been located and sent printed lists of questions directly pertaining to beekeeping as conducted by the owners. The larger per cent of these blanks were filled in carefully and returned. On nearly every blank names were given of additional beekeepers, to whom blanks were also sent. As a result of this study, continued for 7 years, together with data gathered from the experimental apiary which was installed at the Agricultural Experiment Station when the work was first begun, some interesting and valuable information has been gathered concerning the beekeeping interests of Tennessee. To present as well as to prospective beekeepers this information should be of value. This bulletin will greatly facilitate correspondence coming to the Agricultural College and to this Office inquiring about beekeeping. The inquiries are increasing in number as these investigations are being carried on. Information thus far gathered shows conclusively that Tennessee is well adapted for beekeeping. The varied flora, the abundant rainfall, the number of growing days, and the mild winters are all important factors pointing toward success to him who will keep strong bees of the right kind in a modern way. According to the U. S. Census of 1900, there were 38,300 farms in Tennessee upon which honey bees were kept. The accompanying map locates by means of small spots the number of apiaries having 10 and more colonies, which have been located by our survey and from which we have gathered information for the contents of this bulletin. Since 1905 the beekeeping interests in Tennessee have increased fully 50 per cent and the business is still growing. As this bulletin goes to press 6 beekeepers having large interests in as many Northern States came to this Office seeking information concerning the possibilities of Tennessee as a honey-producing State. Some 20 letters from beekeepers in other states seeking the same information have been received within the last three months.

Perhaps the greatest good the investigation of the beekeeping interests in Tennessee has done is to show the urgent demand for simple instructions and an apiary inspection. Since 1911 an Apiary Inspection Law has been in effect and already the importance of this work has been felt.

For the loan of cuts: Figs. 1, 2, 7, 32, and 35 on pages 10, 12, 32, and 33, grateful acknowledgment is due Doubleday, Page & Co., New York; also the A. I. Root Co., of Medina, Ohio, for cuts Figs. 5, 9, 10, 20, 23, 24, 25, 28, 34, 36, 37, and 44, on pages 11, 13, 21, 24, 25, 28, 33, and 39.

For assistance in making photographs, credit and appreciation are due F. H. Broome of the Agricultural Experiment Station, Knoxville.

SHOWING APIARIES OF STATE DOTTED IN



MAP 1—THE SURVEY OF THE BEEKEEPING INDUSTRY IN TENNESSEE. EACH SPOT LOCATES AN APIARY OF 10 OR MORE COLONIES

INTRODUCTION

From frequent written articles and lectures on beekeeping we are led to believe that anyone, without preparation, can make a success in beekeeping. Too many times the drawbacks met by nearly every keeper of bees are not mentioned; neither is due importance placed upon the preliminary knowledge of beekeeping. Beekeeping today is coming to be restricted more to the expert than to the general farmer. The day when nearly every farm in the State had a few hives of bees has passed. It has been found that to keep bees in a hollowed out log or a soap box; to rob them once a year and get a mixture of poor honey and dead bees, is neither a pleasant nor a profitable business. Bees kept in these conditions have in many cases become so weakened, doubtless from disease—American and European foul brood, or both—that the bee moth has easily overcome the colonies. To determine what trouble the general farmer is having with bees a blank has been sent to 3,000 persons in all parts of Tennessee, and the general complaint is that the "weevil" or "bee moth" is so bad that bees can not be kept in their locality. This is a sure indication that the persons reporting this trouble are not familiar with beekeeping, for the bee moth can not overcome a colony of bees when the colony is strong and healthy. The trouble resulting from bee moth really is secondary, and is a strong indication either that the bees are queenless or that foul brood is present, causing the colony to dwindle and weaken. That the prospective beekeeper may not be misled by flowery statements making beekeeping to the unexperienced a "get-rich-quick scheme," that beekeeping on the farm may be built up, and that commercial apiaries may profitably be conducted in Tennessee are the purposes of this bulletin.

It is a fact that beekeeping in Tennessee can be conducted profitably when managed carefully by putting into practice what has been found out by experts in the management and use of modern appliances. Beekeeping should be encouraged, as it may well form a vocation for the young as well as for the old, for those living in the city as well as those living in the country, for the hale and hearty as well as those suffering from impaired health. Emphasis, however, should be laid upon the importance of beginning in a small way and developing as one's interests and love for beekeeping enlarges. In the wintertime and on rainy days the beekeeper gets his hives in readiness for the coming honey flow. When spring comes and the bees begin to fly, a short time spent examining the bees will furnish information as to their condition. It is not advisable, however, that the hives be opened at this time if the weather is cool. The condition of the bees in the spring will usually be an index as to how they were prepared for winter. Bees which are strong and active are those which had plenty of honey and a strong colony. In this State bees winter well out of doors, but care should be taken to see that they have plenty of honey, a surplus of 25 to 30 pounds will be sufficient.

THE LIFE AND HABITS OF THE HONEY BEE

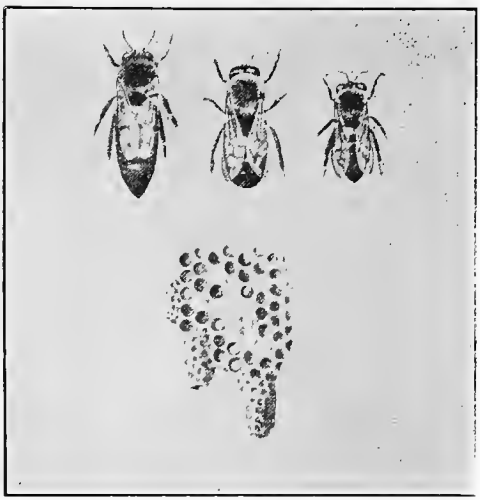


FIG. 1—INMATES OF THE HIVE

The inmates of the hive, known as the colony, consist during the spring and summer months of 300,000 workers, 300 drones, and 1 queen. The accompanying cut pictures a representative of each Some beekeepers by careful manipulation use 2 queens, but this is not to be recommended for the amateur. Success in beekeeping depends largely upon the bees which are kept as much as the care given to them. Table on page 37 for the three predominating kinds of honey bees in Tennessee emphasizes this fact. There are a few Carniolian and Cyprian bees kept in the State. The hybrids of the Italian

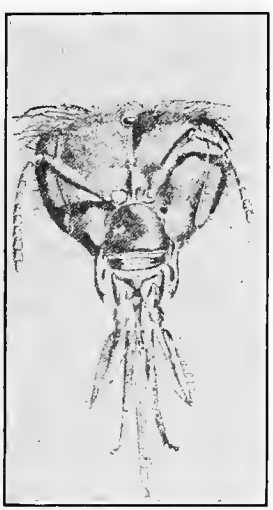


FIG. 2—HEAD AND TONGUE OF HONEY BEE
(After Cheshire)

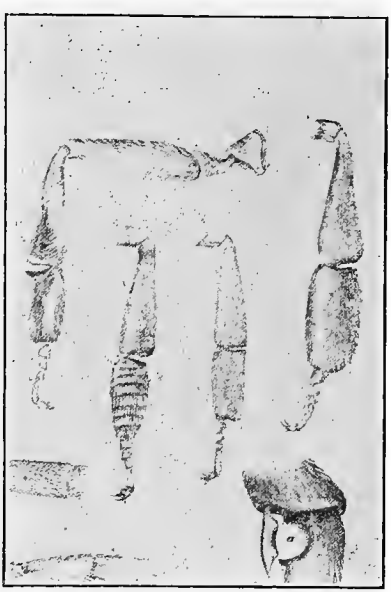


FIG. 3—LEGS OF THE HONEY BEE
a, ANTENNA CLEANER
(After Hammar)

and black bees surpass all others in the number of colonies. It is a rather difficult matter to keep the strain pure if you have neighbors within three or four miles of you who keep a different variety of bees. Thus it is that the great number of hybrid colonies have resulted. The table referred to is conclusive as to the bees which should be kept in this State. It might be well to say that Italian bees have varieties known as the three-banded, the five-banded, and the golden. Of these the three- or five-banded have given best results.

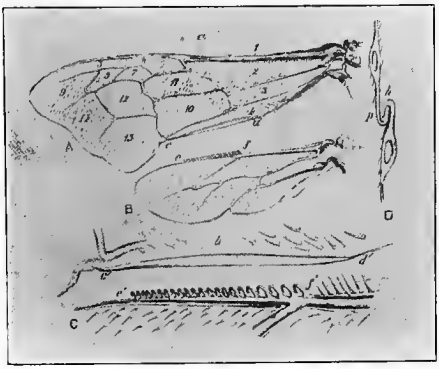


FIG. 6—A AND B. FRONT AND BACK PAIR OF WINGS OF HONEY BEE
C. HOOKS OF BACK WING
D. EYELETS OF FRONT WING
(After Cheshire)

The Queen The beginner in beekeeping should by all means secure a good queen. The life of a queen is from three to five years, and at the end of this time a new one should be introduced into the colony. Many of the apiaries of the State are gradually dwindling simply because the queens have passed their period of usefulness. The function of the queen is to lay fertile and infertile eggs. From the fertile come workers or queens, according to the food which the young receive. From the infertile come the drones. A desirable queen will lay from 2,000 to 4,000 eggs during a period of 24 hours. In the selection of a queen one should have the advice of an experienced beekeeper or deal with a strictly reliable queen breeder. After a fertile egg has been in the cell 3 days it hatches into a very small, grub-like larva. If a queen is to be developed this larva is given special attention by the young worker bees. It is fed a "royal jelly." As the larva grows the cell is enlarged and is usually in the form of a cone-like tubercle. The grub life of the queen bee is completed in 5½ days, after which it is carefully sealed by the bees to protect it from the queen which is already in the hive. During the 7 days the bee changes and becomes similar to the adult and begins to chew off the covering. About this time, if the old queen of the hive does not decide to swarm, taking with her most of the old bees, the newly emerged queen has to gain her possession of the hive by a duel with the old queen. It will be noticed that the queen will develop in 15 or 16 days. If the old queen leaves the

FIG. 5—THE DIGESTIVE SYSTEM OF THE HONEY BEE, SHOWING HONEY SAC

hive the new queen falls immediately into possession and the new colony is formed with the new brood emerging at this time.

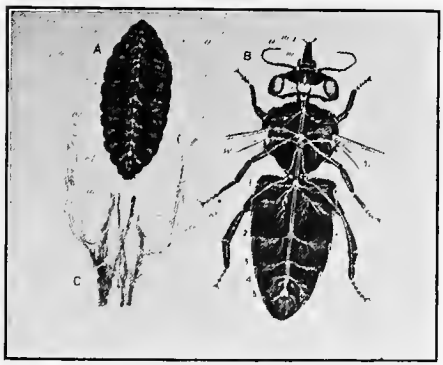


FIG. 6, A AND B, NERVE SYSTEMS OF YOUNG AND ADULT HONEY BEE C, GANGLION
(after Cheshire)

The Drones The drones are present in the hive only during the spring and summer. In number they usually vary from 50 to 300. They gather no honey; neither do they perform any of the duties about the hive; yet they are a drain on the honey supply. The drones are not provided with stingers, although they make a louder noise and are considerably larger than the workers. They may be easily recognized by their size and their bluntly rounded abdomens. Their sole function is fulfilled in mating with the young queen as she takes her maiden flight from the hive during the warm, bright days of spring. When the honey flow begins to lessen, or at the approach of cold weather, the drones are killed and the colony passes the winter without a single representative. As mentioned above, the drone develops from an infertile egg, which may be deposited by the queen, or in case of a queenless colony, by a worker bee. The drone, like the queen and worker, passes through three stages before becoming fully developed. He takes longer to go through these changes than either the queen or the worker.

The workers The workers make up the mass of the bees in the colony. In number they vary from 20,000 to 300,000, according to the strength of the colony. Their duties are varied. The young bees nurse the developing larvae, and keep the hive clean. The older bees ward off robbers or intruding pests, go afield gathering the nectar of flowers three and four miles away, bringing it to the hive and depositing it in the cells already

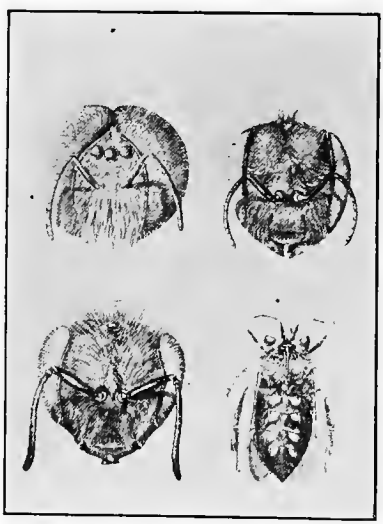


FIG. 7—HEAD OF DRONE, UPPER LEFT HAND CORNER. HEAD OF QUEEN, UPPER RIGHT HAND CORNER. HEAD OF WORKER, LOWER LEFT HAND CORNER. VENTRAL VIEW OF BEE SHOWING WAX PLATES, LOWER RIGHT HAND CORNER
(After Hammar)

prepared by other worker bees which remained at home. Still other worker bees go afield gathering pollen, which when mixed with saliva forms the beebread or food of the young bee. The workers are also the source of the wax used in making the comb and cappings. The bee glue or propolis is used in sealing up cracks and firmly fastening the parts of the hive together. Should the honey be too thin for capping it is the worker bee who performs the process of evaporating the surplus water. This is done by rapid action of its wings. The steps in the life-history of the worker are very similar to those of the queen. The main exceptions are that a worker is not fed the "royal jelly" and the worker requires 21 days to develop.

The following table shows the days required for the development of the different members of the hive:

	Egg	Larva	Pupa	Total
Queen ..	3	5½	7	15½
Worker .	3	5	13	21
Drone ..	3	6	15	24

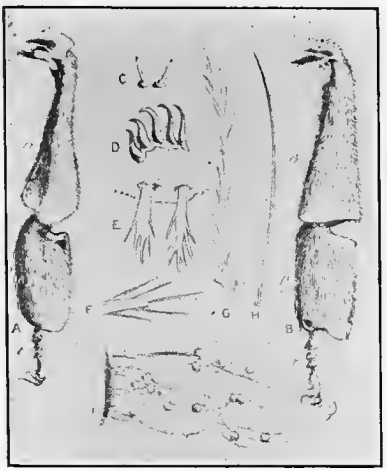


FIG. 8—A, THIRD LEG OF DRONE.
B, THIRD LEG OF QUEEN
C, SENSORY HAIRS FROM LABIAL PALPUS.
D, SENSORY HAIRS FROM MAXILLA.
E, SPLIT HAIRS ON TONGUE.
I, HAIRS AND POLLEN

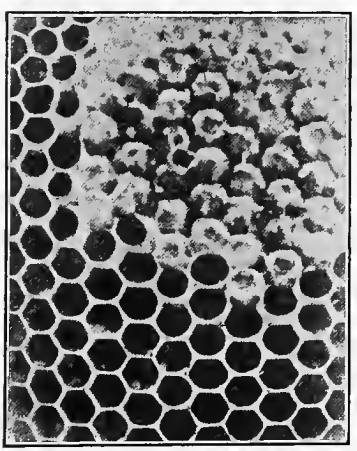


FIG. 9—DRONE CELLS USED FOR HONEY STORAGE—LOWER EDGE OF CELL IS CAPPED FIRST

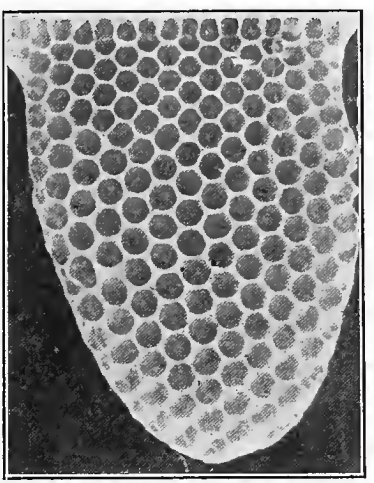


FIG. 10—A COMBINATION OF WORKER AND DRONE CELLS. THE SMALLER CELLS AT TOP ARE WORKER CELLS

NECESSARY EQUIPMENT

Like all other industries when first undertaken, beekeeping should begin in a simple way. If you are not acquainted with bees it is best to begin with one colony and one or two good books on beekeeping, and subscribe for one of the best bee journals. Study the living bees and your publications together. It will take only a comparatively short time—about one season—to increase your colonies and

FIG. 11—SOME RELIABLE BOOKS AND JOURNALS ON BEEKEEPING

prepare for making honey. The equipment necessary, while simple, is peculiarly adapted to the business.

The modern hive

Use nothing but the modern hive; one that may be opened from time to time, permitting you to study the condition of the bees. There are many kinds of modern hives to which the inventor's name is still attached. A 10-frame hive is preferable to any other. A hive constructed on the principles of the Langstroth, with 10 Hoffman frames, with a shallow

FIG. 12—A 10-FRAMED STORY AND HALF MODERN HIVE—SHOWING EXTERNAL PARTS

super, will give the beginner a good hive.

A smoker will be needed whenever you are working about the bees; also a bee veil which may be readily slipped over the hat to protect the face and neck. A good screwdriver or hive tool facilitates the ease of opening the hive and removing frames or sections.

Avoid expensive and numerous supplies.

In your list of supplies include a queen-excluding honey board. This is a perforated metal-and-wood device the size of the top of the

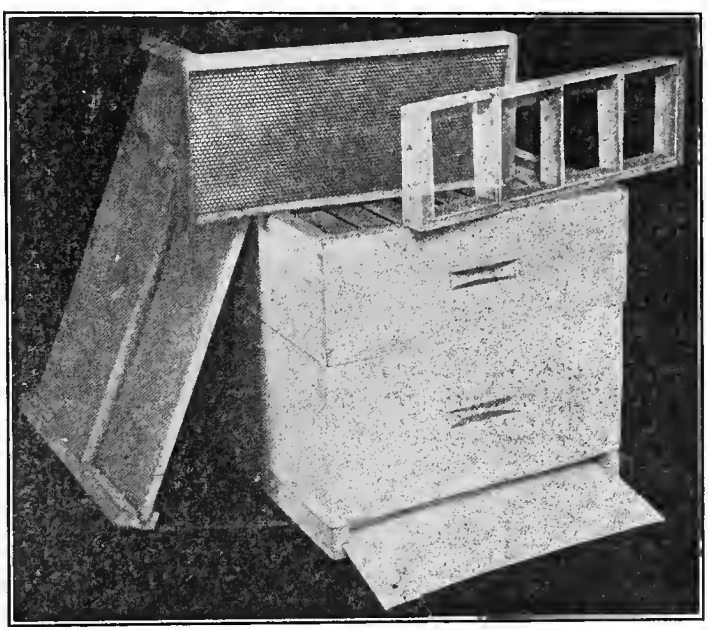


FIG. 13—A MODERN HIVE—SHOWING INTERIOR PARTS
Cover at side of hive brood frame and section frame on top of hive

hive and is used to exclude the queen from the super. Order sufficient medium brood and light section foundations; also some No. 30 tinned wire and a spur-wheel wire imbedder. In buying hives get them in lots of five unnailed or "in the flat" at a considerable saving. Liberal discounts on all apiary supplies are allowed during the winter and early spring months. Also if you are a member of the State Beekeepers' Association, you will be able to buy bee supplies at a discount.

PLEASURE AND PROFIT IN MODERN BEEKEEPING

As a side line, considering the expense of installation, there is no more interesting and profitable business than beekeeping. Not only is this true for the fruitgrower and farmer, but to the residents of cities, those in mercantile and professional lines. Some of the best beekeepers are women. True it is that time and attention and preliminary knowledge are necessary; but experience will be gained rapidly when the living bees are studied in connection with printed instructions. A visit to an apiary conducted by a practical beekeeper will furnish valuable suggestions and interest in the work. No one who wishes to derive the greatest pleasure and profit from his bees should expect the little fellows to do good work unless provided with suitable hives. Do not for a moment attempt to keep bees in hollow logs or plank boxes; instead have modern hives which can be opened from time to time so that the true condition of your bees may be studied. Surplus honey may be taken off without destroying your bees, even disturbing them. Should your bees become diseased it will be an easy matter, with a separable hive, to inspect them and determine the cause.

Hive and bees affect yield

From careful statistics gathered from different parts of the State we learn that the production of honey is affected not only by the kind of bees, but by the style of hive in which the bees are kept, as shown by the following table:

Style of hive	Number of apiaries	Average yield of honey per hive	Average price per pound extracted honey	Value of of honey per colony
Log gums	22	15 lbs.	10 c	$1.50
Plank, box hives	34	18 lbs.	11½c	2.07
Frame or modern hives	173	39½ lbs.	12½c	4.94

Hive parts

These figures prove conclusively that it is economy to use the modern hive. This may be equipped with a bottom board, brood chamber, with entrance, queen-excluding honey board, super, and cover. The accompanying figure shows the arrangement of these parts. The super may have shallow extracting frames 5⅝ inches by 17⅝, or it may have small boxes or sections, 4 inches by 5. It has been found that a larger amount of honey will be stored if the frames are used. The hives should be of good size. The hive giving best results is a 10-frame hive. The writer is inclined to favor the Langstroth style with Hoffman frames. The producer of extracted honey may wish to have interchangeable brood chambers and supers.

Full sheets of foundation

The frames of the hive should have full sheets of foundation put into them and wired. Full sheets of foundation should also be used in the frames or section in the super. It is important that this be done, for the making of wax by the bees is a slow and exhausting process, and very expensive, too, when you consider the

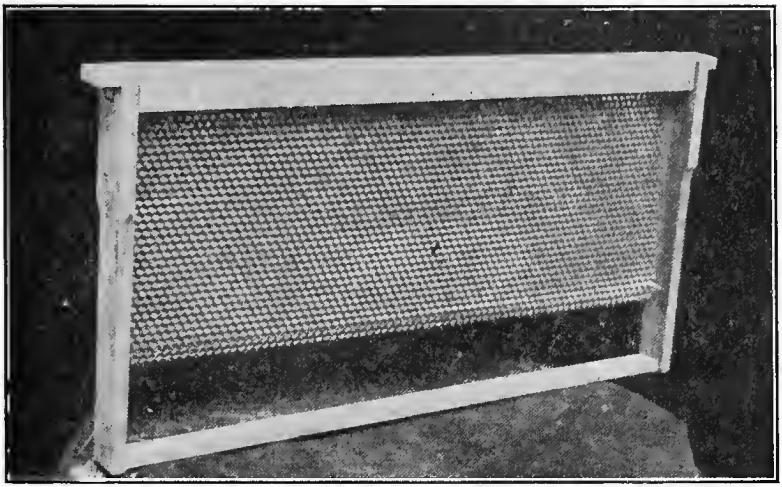


FIG. 14—A HOFFMANN FRAME WITH FOUNDATION 9⅛ INCHES BY 17⅝

loss of time of your bees and the quantity of honey which they might gather. If you have observed your bees you have noticed them from time to time hanging themselves up in rope-like strings among the frames and on the sides of the hive. During this time there are few bees gathering honey. Were you to watch carefully you would find that after several days there would be a small accumulation of wax at 8 different places on the underside of the bee's body. This is the

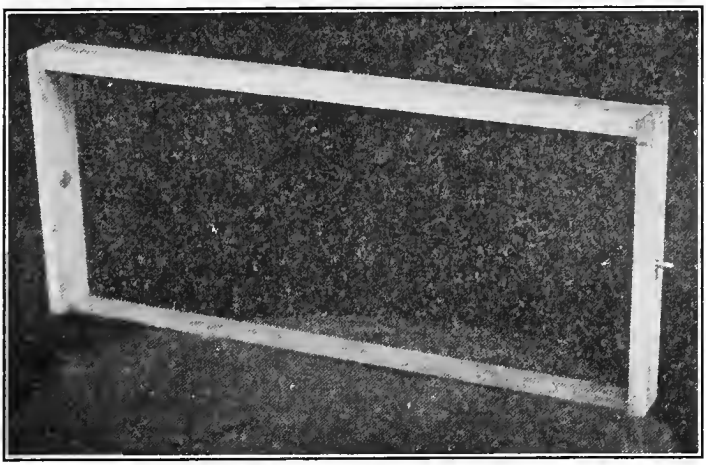


FIG. 15—DANZENBAKER BROOD FRAME, 7½ INCHES BY 17

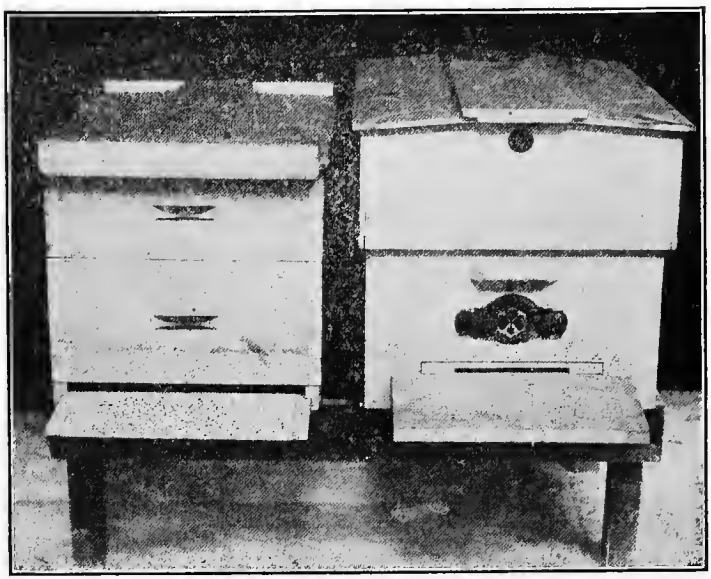


FIG. 16—A SINGLE AND DOUBLE-WALLED HIVE

newly formed beeswax. Before this wax can be made a large amount of honey must be consumed by the bee. A careful observer has found that it requires 20 pounds of honey to produce 1 pound of wax. Counting honey at 15 cents per pound and beeswax at 30 cents per pound, you will see how important it is to use full sheets of foundation instead of narrow strips as starters as has been recommended by many beekeepers in the past. It should be the object of every beekeeper to save his bees from producing more wax than is really necessary, for every pound of beeswax produced in the hive costs the beekeeper $2.70, to say nothing of the time and energy required by the bees to produce it.

Transferring from the box or log gum to modern hives

Having decided that it is not economical to keep bees in the box or log gum, and that the use of brimstone to kill the bees whenever honey is to be taken is extravagance, we want to start aright, and suggestions as to how to transfer with the least inconvenience are in order. Lighting your smoker and putting a bee veil over your face, approach the box or gum, puffing a little smoke into the entrance. The modern hive is placed in the exact position of the old one. The log gum is split apart or the box hive is opened and the larger pieces of comb with the bees are removed and placed into the frames of the new hive. These pieces are held in place by wire, strings or sticks. After all the larger pieces of comb have been placed in the new frame the surplus bees may be shaken on a piece of cloth spread at the entrance to the new hive. The operator should take pains to see that the queen gets into the new hive uninjured. A little smoke now and then may be used

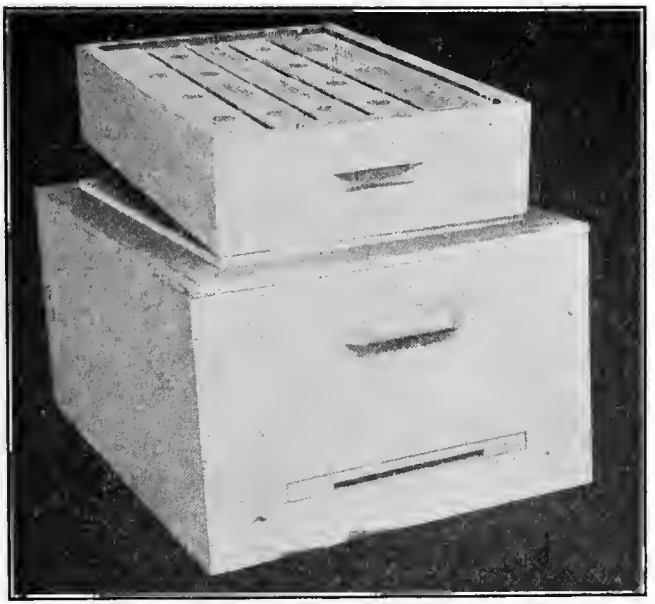


FIG. 17—DOUBLE-WALLED HIVE. WHERE SHADE IS IMPOSSIBLE USE THIS TYPE OF HIVE

to quiet the bees during the operation of transferring. In a short time they will become quiet and if the honey flow is on at the time the bees will soon make the repairs to the broken comb and begin building new. Great care should be taken to prevent robbing. It is well to transfer when the bees are busy gathering honey, and the work should be done as soon as possible, care being taken to leave but little broken honey exposed. Brood comb taken from the old hive should be placed near the center of the new hive. After the comb and bees have been introduced into the modern hive it is well to contract the entrance to the hive. If the colony is strong the bees will soon join all the parts, and fasten all the combs securely to the frames, when the sticks, wire or string may be removed.

Swarming

From the middle of April to the middle of June one may expect from the strong colonies sufficient increase to make it necessary for a swarm to come forth unless precautions are taken by giving space and ventilation, or by dividing the colony. Swarming is the natural method of reproduction among the bees. It is the old queen and the old bees which leave the hive seeking new quarters. When indications of swarming appear immediate attention is necessary. The hive with 10 frames with full sheets of foundation or frames containing empty comb should be ready and as soon as the swarm is out the new hive should be placed in exactly the same position as the old one, which may be set a few feet to the side. The swarm made up of the old bees advances from the hive, followed by the queen. After flying about for a short time they cluster on some near-by object. It may

be a tree, a bush, a post, or a building. Here the swarm remains for an indefinite length of time, during which scouts are supposed to be seeking a suitable new home. Swarming time is an occasion of great excitement, and by the older beekeeper the settling of the swarm was supposed to be encouraged when bells were rung and pans drummed upon or sand thrown into the air. The modern swarm causes very little excitement, for the queen's wing has been clipped on one side and the swarm will be found only a short way from the hive, usually on the ground. The new hive having been placed, the swarm is now taken to the entrance of the hive and shaken on the cloth spread before the entrance. In a few minutes all the bees pass within and usually they remain adapting the new hive for their new home. Certain precautions are important. Due care should be taken not to injure the queen, and the new hive should not be too warm. If the hive is new and strongly scented with pitch it is well to bruise grass or leaves on the sides to neutralize the odor. If all has gone well the swarm becomes quiet and in a few days all the bees are working normally. There are times when from conditions the bees do not seem to adapt the new home and settle down. In this case to introduce a frame or two of brood from some strong colony will correct the trouble.

FIG. 18—HIVE WITH INTERCHANGEABLE BROOD CHAMBER AND SUPER
Veil and smoker on hive

Methods to prevent swarming

There are times when the beekeeper will find it economical to prevent swarming. This may be to prevent a second swarm from a colony, or it may be to prevent a very late swarm which would not have sufficient time to build up and get strong before cold weather, or it may be that the beekeeper already has as many swarms as he wishes to care for. Much has been written in regard to methods to prevent swarming. It is interesting indeed to note the various ways adopted by different beekeepers in the different part of the State. From experiments at the experimental apiary it is evident that the same method will not always accomplish the same purpose, but from experiments covering 7 years the following methods have been found most successful: To examine the bees and to know their condition in regard to brood and number of bees in the hive has been found most advantageous. Frequently the simple matter of additional space

FIG. 19—A TENNESSEE APIARY

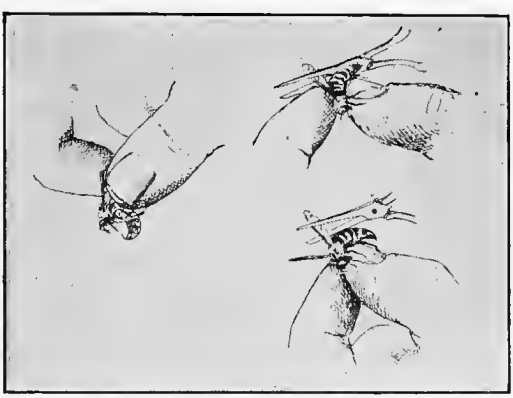


FIG. 20—CLIPPING THE QUEEN'S WINGS

and better ventilation will prevent a swarm. Again, after inspecting a colony which shows indication of swarming, to cut out the queen cells and provide more space in the hive acts as a check. Very successful indeed has been the method of removing three or four frames of brood and inserting in their places frames and empty comb. In this case one would increase the number of colonies but would prevent the swarm. The advantages derived from this separation of a colony are, first, to suit the work to the operator's convenience; second, to facilitate hiving, if the clipped queen is not used; third, and perhaps the most important of all, to save the bee's time in gathering honey.

Italianizing

Many questions have come to us in regard to the getting of a better strain of bees. The beekeeper has realized that his bees are not collecting the honey they should and that they are vicious, and having read of the

FIG. 21—IN THE MIDST OF THE HONEY FLOW.

strains which are very productive and are extremely gentle, he would like to know how to get these desirable strains introduced.

From a reliable queen breeder secure a three-banded or five-banded Italian queen. At the close of this bulletin will be found a list of queen breeders and firms who can furnish you bee supplies of all kinds. For this queen it will be necessary to pay from 50 cents to $2.50, according to the time of the year and the merits of the queen. The queen will be shipped to you in a wire-and-wooden cage accompanied by three or four worker bees. The next step is to introduce the new queen into your old colony. There are different ways of doing this. Experience teaches, however, that success usually results from placing the wire cage, the entrance of which is stopped with candy, in the middle of the hive on top of the frames. After the hive is opened it is well to take out the middle frame and find the old queen and remove her previous to introducing the new queen. The bees will soon find the wire cage and begin to cut away the candy from the entrance. The worker bees on the inside of the cage will also begin eating, and by the time the entrance is cleared the bees will have become well acquainted and the fertilized queen begins almost immediately to lay pure Italian eggs. In about 28 days the Italian workers begin to come out of the hive and in a month or six weeks, during the honey flow, most of the native bees will have died, thus leaving you a pure strain of bees. Through the summer months open each hive every few days and examine the brood cells. It is not necessary to disturb the bees very much in doing this. Honey may also be taken from time to time from the hives with little if any disturbance to the bees.

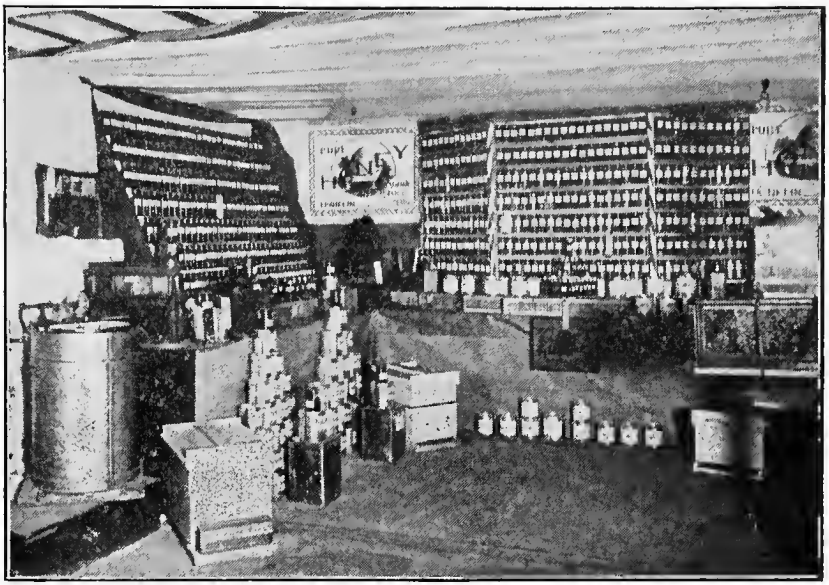


FIG. 22—EXHIBITION OF THE PRODUCTS OF THE BEE.

Taking honey from the bees

The word "robbing," meaning the taking of honey from the bees, is an obsolete word in modern beekeeping, for never is the hive robbed of its honey. In the brood chamber the honey and brood is never disturbed unless it may be at certain times to cut out drone cells. The honey is taken from the super. It is the surplus honey in which there is no brood if preacutions have been taken. At this point it might be stated that it is always well to have a queen-excluding honey board between the brood chamber and the super. This will prevent the queen from going into the super and depositing eggs. To remove honey simply lift off the super a day or two before you wish to take out your honey and insert a bee escape between the super and the brood chamber. This device allows the bees to go from the super to the brood chamber but not to return. This having been been done, when you remove the honey there will be no bees present. After the filled frames or sections have been removed replace empty ones with full sheets of foundation.

Marketing honey

Too much stress can not be laid upon the importance of the appearance of your products from the apiary. If honey is sold in pound sections all propolis, or bee glue, should be removed from the wood, and it is sometimes well to bleach the caps with burning sulphur. The sections may be placed in neat pasteboard cartons, making the honey more attractive and carrying out the idea of sanitation. It will be worth your while to adopt a brand, and grade very carefully all the products leaving your apiary. A large majority of the people in Tennessee sell "chunk honey;" which is honey comb as it is cut from the frames. It is usually sold in buckets or glass jars. It sells for less than the pound sections and for little more than extracted honey.

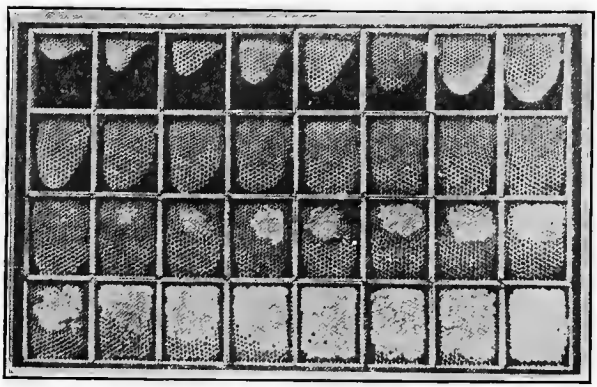


FIG. 23—THE DEVELOPMENT OF COMB HONEY

At this point emphasis should be laid upon the waste of honey comb. Since the passage of the Pure Food Law on June 30, 1906, the use of extracted honey has greatly increased and every beekeeper should use his influence to make this the popular form in which to sell honey. It is economical both to the consumer and to the beekeeper, and the Pure Food requirements prevent adulteration, which in the past has been detrimental to the sale of any form of extract honey, and this has been the chief means of popularizing comb honey. A honey extractor for extracting the honey from the frame will effect a great saving in the life of the bees and will increase the honey production. It will be as easy to get a reputation for a certain brand of extract honey neatly put in glass jars or in tin cans. A practical beekeeper recently told the writer that he valued every frame of empty comb which he had at $1.00. The actual amount of wax in this comb is much less than a pound, but the beekeeper has in mind the conservation of the life and energy of his bees as well as the time consumed in making the wax. The time to sell your honey will be governed by two things. If you have a suitable place for storing your surplus, a better price frequently may be secured later in the season after the honey flow has ceased. In Tennessee the best prices are paid for honey during the holiday season. If you have no place to store your surplus honey it will be best to sell it immediately upon taking it from the hive. Early honey in this case will bring a good price, as well as that taken in the early fall.

Robbing among the bees

There is nothing connected with beekeeping that will try the patience of the beekeeper more than robbing among his bees. If this be continued for any length of time serious losses may result. Even in the best managed apiaries there will be colonies of varying strengths. At certain times there may be weak colonies which are liable to be attacked during robbing and completely destroyed. Even with the strong colonies there is frequently a considerable loss of bees in the attempt to ward off the robbers. Robbing is often induced by too large an entrance to the hive; and sometimes by covers being raised and left up to increase ventilation; but the chief cause of robbing is the careless exposure of bits of honey or parts of hives to which honey is attached. When the honey flow is on it is rare that robbing takes place but during a dearth of honey flow the least provocation will start robbing.

Remedies: To contract the entrance of the hive; also to place before the entrance a cloth soaked with a few drops of carbolic acid or asparagus tops or grass. It is sometimes necessary entirely to close the entrance to the hive containing the weak colonies or remove it to some enclosure away from the robbers. The best course, however, is that of precaution. Knowing those things which induce robbing, the beekeeper should exercise every care to prevent it.

Suitable site for an apiary

The apiary may be placed in the dooryard, in the orchard, in the meadow, at the edge of woodland, or on a hillside. If the hillside be chosen and the hill be of considerable height, it is well to have the apiary located about half way up. Bees may be successfully kept in houses having entrances through the sides of the building. Bees may also be kept upon roofs of high buildings. Here, at the University of Tennessee, a hive of bees set before an open window of the third story of Morrill Hall has done as well as colonies on the University Farm. Wherever your bees are kept, it is necessary to have a certain amount of shade. An ideal site is one which would protect the bees from the midday sun but would give them an opportunity of having the morning and late afternoon sun. The hives should be more or less protected from the prevailing winds. In this State the California privet grows very rapidly and will quickly furnish a very desirable windbrake for an apiary. The hives should be faced to the east of southeast, with lighting board slightly elevated from the support. Several experiments with hive stands at varying heights have proved that a low stand is preferable. If the hives are 8, 10, or 12 inches above the ground the heavily laden bees returning from the field will often drop to the ground before reaching the entrance, losing considerable time, if they gain the entrance at all. If hives are on rather high stands it is well to have a sloping entrance reach-

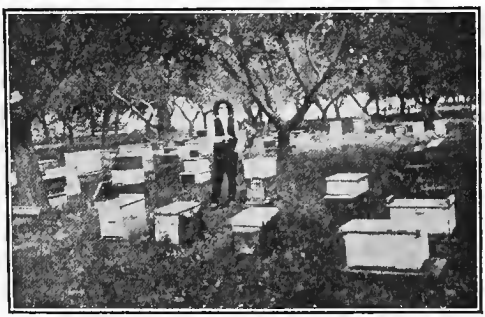


FIG. 24—THE ORCHARD AS A SITE FOR AN APIARY

FIG. 25—ARRANGEMENT OF HIVES BY TWOS

FIG. 26—NEVER SPRAY WHEN TREES ARE IN BLOOM; FLOWERS AND BEES WILL BE INJURED; BOTH ARE NECESSARY FOR A FRUIT CROP

ing nearly to the ground. The question is raised by some as to whether a hive on a low stand is likely to become infested with ants, roaches, mice, etc. We have had no trouble of this kind excepting in one case where the colony was very weak. The hives may be arranged separately or in pairs. We are using a low stand containing two hives with about 8 or 10 inches between. Several of the better beekeepers of the State are keeping bees after this method and several have the stands single with from 5 to 10 feet between. The writer is inclined to think that the location of hives in an apiary is a matter more to be decided by the operator. The hives should all face in the same direction, and between the row there should be sufficient room for the bees to rise up out of the way of the operator. Referring again to the matter of shade, the growth should be of a kind which sheds its leaves in winter and produces not too dense a shade in summer. In case it is impossible to have shade a double-walled hive will be found advantageous. The hive should be placed on a stand nearly level from side to side with a very slight tilt forward to allow water to run out in case of a beating rain. The grass should be kept short around the hive so that the bees may have free access to the entrance.

Moving bees

The prospective beekeeper wishing to secure a few colonies of bees may start in one of three ways. He may secure from a reliable beekeeper a small hive of three or four frames of pure-blooded bees, known as a "nucleus." These should be purchased in the early spring, in March or April. They may be put into a regulation-size hive, and as the brood hatches the colony will be increased to fill the hive. In this case it is well to keep watch of the bees and prevent them from swarming the first year. This way of starting beekeeping is to be highly recommended.

A second way of making a start is to secure from a beekeeper a colony or two in modern hives and move them to the desired location in March or April. If these are strong colonies one may expect a swarm in the latter part of April or of May. By securing bees in the early spring one has the advantage of a swarm to increase the colonies.

The third method is to buy log gums or box hives containing the black, or German, bees and plan to transfer them into a modern 10-frame hive and Italianize them with a good queen purchased from a reliable queen breeder. Suggestions for transferring and Italianizing are given in another place in this bulletin.

Feeding

A discussion on feeding may be divided into two heads! viz.: feeding to hasten increase, and feeding to save the colony. Feeding to hasten increase.—Early spring feeding has a tendency to stimulate the rearing of brood. This practice is especially desirable in late springs or when the early spring flowers seem to produce little if any nectar. The result of this stimulation is to produce strong colonies which will be ready to work as soon as the honey flow is on. In the spring as soon as it becomes warm enough to open a hive safely one should inspect the frames to see if there is sufficient honey for the brood and the spring feeding should be governed by this investigation.

Feeding to save the colony.—In the latter part of October the colonies should all be carefully examined to see if they have plenty of surplus honey for the winter months. There should be at least 25 to 30 pounds of honey for winter feeding. In case the fall flowers have not produced sufficient nectar, or in case the colony is weak or is a late swarm, the bees should be fed upon honey or a syrup made by boiling granulated sugar with a small amount of water. The

sugar syrup may be readily made by adding 1 quart of water to 4 pounds of granulated sugar. Bring this to a boil and skim.

Kinds of feeders

When feeding, every precaution should be used to prevent bees from robbing. Hence it is well to feed rather late in the evening or to use a feeder which does not open outside of the hive. There are various kinds of feeders. Two of these are shown in the accompanying cuts.

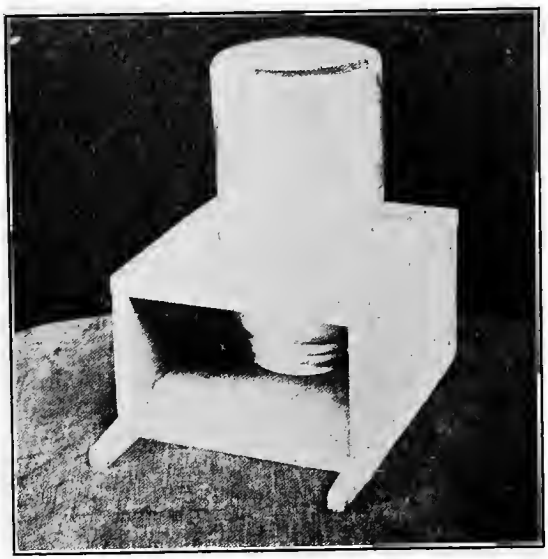


FIG. 27—THE BOARDMAN ENTRANCE FEEDER

The Boardman entrance feeder consists of an inverted Mason fruit jar the cover of which is perforated with many fine holes. The syrup or honey is placed in the jar; the jar is inverted and placed in the block, which holds it in an upright position. This block is then placed in the entrance of a hive.

The Alexander feeder is highly recommended as a spring feeder for stimulative purposes. This feeder fits beneath the brood chamber at the end of the bottom board, with entrance projecting to the side. It is very convenient to refill. The block covering the projection prevents outside bees from getting to the feed.

The Doolittle division-board feeder consists of simply a box opened at the top which occupies the space of a brood frame. This feeder is placed in the hive and is especially recommended for feeding during cool weather.

Reference to any of the leading bee supply catalogues will give additional information on feeding devices.

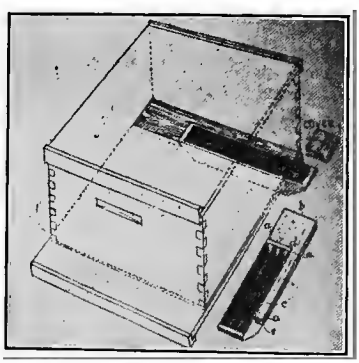


FIG. 28—THE ALEXANDER BOTTOM-BOARD FEEDER

The sting of the bee

To the beekeeper the sting occasionally received when he is tending his bees means nothing, but for the beginner this sting is that of which he lives in fear and often prevents him from deriving pleasure from his bees. It is, however, only a short time

before the beginner gets very bold, and proud is he when without veil or gloves he approaches the hive and with the use of a little smoke handles his bees with impunity. It is a fact that the sting affects different people in different ways, but the writer believes it is also a fact that one can to a greater or less extent become immune to the poison resulting from the sting. Upon receiving the sting from the honey bee, immediately remove the stinger by means of a knife or a finger nail by pushing the stinger sideways. Never use the fingers or a pair of forceps to try to extract the stinger for in doing this more of the poison, or formic acid, is injected and more serious will be the result of the sting. A little honey smeared over the affected spot will give relief as quickly as anything. The best recommendation, however, is that of prevention. Secure gentle Italian bees, and do away with the common black ill-tempered bees. Visit the apiary often, learn the behavior of the bees; and the bees will come to know you the same as higher animals do. Work among your bees leisurely, avoiding all quick motions and in opening a hive do it as carefully as you can. Use the smoker judiciously.

Kind of bees

At another place reference is made to the undesirability of the black, or German, bee and the three- or five-banded Italians are recommended. This information for the amateur should be sufficient; yet it may not be out of place here to say that there are many races of bees, each of which has its own individuality. The following table is taken from "Cook's Manual of the Apiary":

Species	Races	Varieties
Apis indica, Fab.	A. Dorsata nigripennis Latr.	
Apis florea, Fab.	A. Dorsata bicolor, Klug.	
Apis dorsata, Fab.	A. Dorsata zonata, Smith.	
Apis Mellifera.	A. Mellifera nigra, German bee.	Carniolin or Krainer Heath Hungarian Dalmatian Herzegovinian Smyrnian Tunisian Common Black
	A. Mellifera fasciata, Egyptian bee.	
	Syrian (?)	
	South Palestin (?)	
	Cyprian (?)	
	Italian (?)	
	Greek (?)	
	Bonnat (?)	
	Caucasian (?)	
	A. Mellifera unicolor Latr. Madagascar	
	A. Mellifera adonsoni, African bee.	

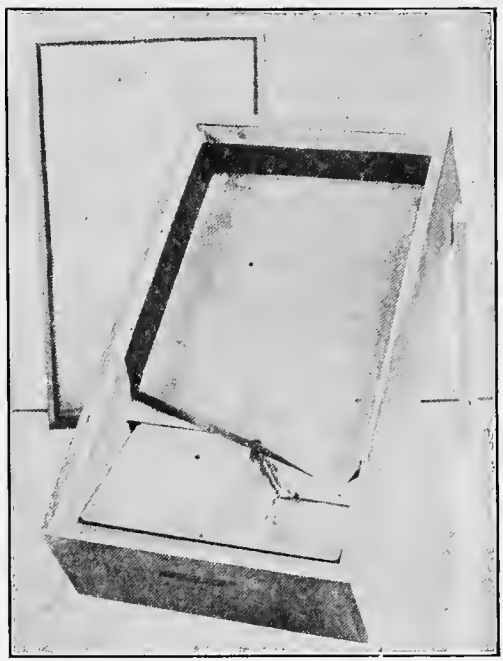


FIG. 29—A SOLAR WAX EXTRACTOR

Beeswax and wax extractor

All cappings and broken pieces of comb should be saved and extracted for beeswax. Beeswax is always in demand in the market and sells for from 28 to 35 cents per pound. The accompanying figure shows a solar wax extractor, which is a very convenient and inexepnsive one. This device may be set so that the rays of the sun will shine directly through the double glass front and the wax will be melted by the heat generated.

FIG. 30—A HONEY EXTRACTOR

Honey extractor

The beekeeper will get his greatest yields by extracting his honey and replacing the empty frames in the super. This is the most economical way of producing honey, there being very little waste of beeswax and the time required of the bees in making the comb. A device for extracting honey is shown in the accompanying figure; it simply being an arrangement in which two frames of honey may be placed and revolved rapidly after the caps have been cut from the comb. This whirling, or centrifugal force, will completely throw the honey from the comb. By turning the frames, both sides may be completely extracted. There are extractors made which are reversible and do not require the removal of the frame until both sides are extracted. Honey extractors are inexpensive and the extra honey produced will soon pay for the equipment.

CHIEF SOURCES OF HONEY IN TENNESSEE

From a special circular letter sent to the largest beekeepers of the State asking them to give the names of the chief nectar-producing flowers in their sectiin, the following was gained. The list given below is arranged in order of importance in the estimation of these practical beekeepers. The number following the name indicates the persons reporting same as a source of honey.

White clover	152	Wireweed	3	Raspberry	1
Poplar	101	Boneset	2	Oak	1
Linden or basswood	96	Buckbush	2	Spanish needle	1
Sourwood	65	Huckleberry	2		
Aster	39	Whortleberry	2		
Black locust	33	Elm	2		
Fruit blossom	29	Yellowwood	2		
Chestnut	19	Daisy fleabane	2		
Goldenrod	19	Heartsease	2		
Stickweed	18	Cane	1		
Red clover	14	Crowfoot moss	1		
Persimmon	14	Willows	1		
Alsike clover	12	Bitterweed	1		
Cowpeas	11	Turnip bloom	1		
Buckwheat	10	Dandelion	1		
Tanglefoot	9	Strawberry	1		
Sumac	8	Pea wood	1		
Maple	8	Cottonwood	1		
Black gum	6	Cedar	1		
Alfalfa	5	Blackberry	1		
Melilotus	4	Catnip	1		
Cotton	4	Fruit berries	1		
Corn	4	Aspen	1		

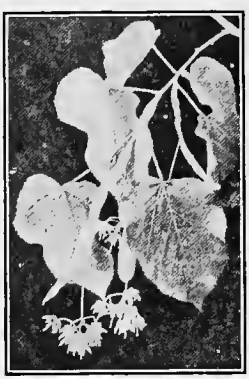


FIG. 31—LINDEN OR BASSWOOD

HONEYDEW

During certain years honeydew is a source of a considerable amount of honey in the different parts of the State. Honeydew is recognized by its shining appearance on leaves, varnishing their upper surfaces. It is often found in considerable quantities on sidewalks beneath trees. During the months of spring and early summer it is in greatest abundance. The sources of honeydew may be mentioned under three heads: from plant lice or aphids; from certain scale insects and from certain plants. By far the greatest source, however, is that of plant lice. This sweet substance is ejected by the plant lice and is frequently thrown some distance, an explanation as to why honeydew is frequently found on leaves above which there are no overhanging trees. The honey made from honeydew seems to be variable according to the source of the honeydew. From aphids it produces a very fair grade of honey, while that from scale insects produces a rather dark, highly scented honey. According to the Food and Drugs Act, pure honey is not produced from honeydew. The definition for pure honey being "The nectar of flowers gathered by bees and stored in honeycomb."

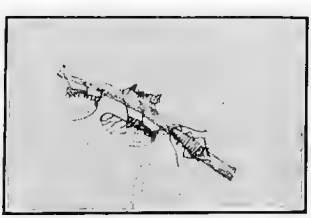


FIG. 39—PLANT LICE, THE CHIEF SOURCE OF HONEYDEW

FIG 32—WHITE CLOVER

FIG. 38—BUCKWHEAT

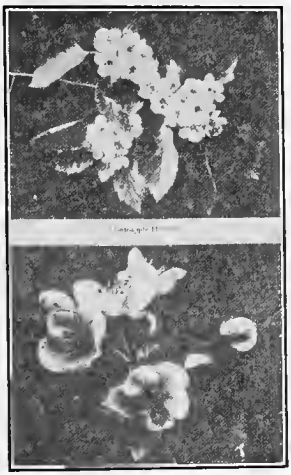


FIG. 35—APPLE BLOSSOMS

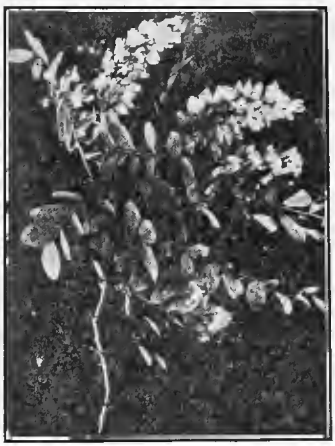


FIG. 33—BLACK LOCUST

RWOOD

FIG. 37—GOLDEN-ROD

PRESENT CONDITIONS AND FUTURE POSSIBILITIES OF BEEKEEPING IN TENNSSEE

At the present time Tennessee ranks fifth in the honey-producing states of the Union. Few people not having the chance to study the beekeeping interests in Tennessee know to what proportions they have attained. Honey production in the State has never been brought properly before the beekeeping world and in a general way little is known as to what is really being done in this line of business by the people of Tennessee. It may be interesting to see a few conservative figures in regard to present conditions obtained from a careful survey of the beekeeping industry.

What the bees save each year

At present there are 144,487 colonies of bees in Tennessee. Estimated at $3.50 per colony, their value would be $505,704.50. The amount invested in honey houses and other apparatus connected with beekeeping, exclusive of hives, would doubtless approximate 6 per cent of this amount, or $30,342.27. From statements received from

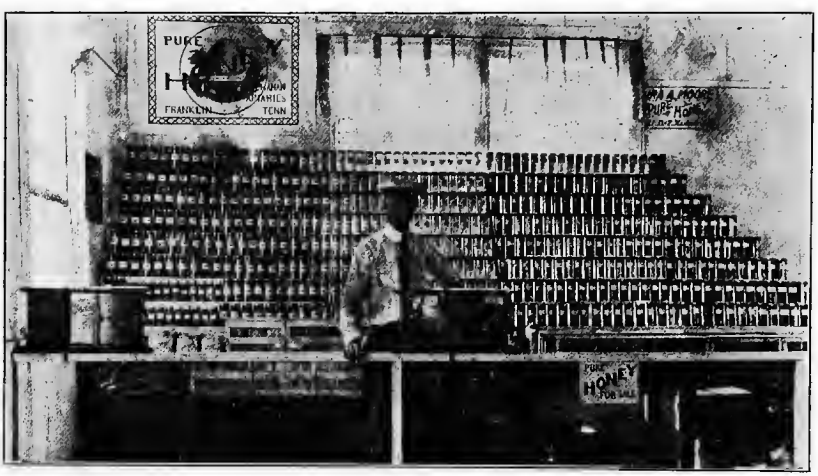


FIG. 40—TENNESSEE HONEY EXHIBIT AT TRI-STATE FAIR, MEMPHIS OCTOBER, 1911.

3,006 beekeepers in the State it is found that the average yield per colony is 39½ pounds of honey. This makes the production of the 144,487 colonies 5,707,236½ pounds of honey, which at an average price of 15 cents per pound aggregates $856,085.48. There are also sold in the State annually $2,500 worth of queens, averaging $1 per queen. At present there is no accurate estimate of the beeswax produced, but the amount is considerable, selling as it does for 28 and 30 cents per pound. Counting a swarm for every two colonies, and valuing them at $1, this would amount to $72,243.50. As a total we thus find the annual output of the beekeeping industry in Tennessee to be—

Bees	$ 505,704.50
Appliances	30,342.27
Honey	856,085.48
Queens	2,500.00
Swarms	72,243.50
Total	$1,466,875.75

State aid

These figures in a conservative way serve to show the importance of the industry of beekeeping as it is in Tennessee today.

With the introduction of more modern appliances and better bees and the proper care, who can estimate its future?

The prospects for the development of this profitable and delightful industry in Tennessee are very good. The passage of a bill by the Legislature of 1911 means much in the building up and fostering of beekeeping. In brief the bill comprises:

"AN ACT to suppress infectious and contagious diseases of bees; to provide for an inspector of apiaries, to define his powers and duties, and to define certain misdemeanors and provide punishment therefor." (Chapter 50, Acts of 1911.) Sections 1 and 2 give the general scope of the Act:

"Section 1. Be it enacted by the General Assembly of the State of Tennessee, That within thirty days from the passage of this Act, the Commissioner of Agriculture shall appoint a duly qualified and competent inspector of Apiaries whose duties it shall be to inspect the bees of the State as prescribed in this Act; and such Inspector of Apiaries shall act under the authority and supervision of the State Board of Entomology.

"Section 2. Be it further enacted, That upon receiving information from any source, of the existence of diseases in any apiary in the State, the Inspector of Apiaries shall examine such apiary, and all others in the same locality, and shall ascertain whether or not the disease known as Foul Brood, or any other disease which is infectious or contagious in its nature, and injurious to honey bees, exists in such apiaries, and shall designate each colony and apiary which he finds infected, and shall notify the owner or the person in charge of such bees thereof; and the owner or person in charge of such bees shall at once practically and in good faith, apply, and thereafter fully carry out upon such diseased bees, such treatment, as may have been prescribed by the Inspector for such cases; and shall also thoroughly disinfect to the satisfaction of the Inspector, all bee hives, combs, honey and apparatus used in connection with such diseased bees; or the said owner or person in charge may, at his election utterly destroy by fire all such infected bees, hives, combs, honey and apparatus."

This work of apiary inspection was begun during the summer of 1911, when 70 apiaries in different parts of Middle and West Tennessee, representing some 800 colonies, were inspected. Of this number 14 apiaries were found affected with the American foul brood, a bacterial disease of bees which if left untreated will scatter readily and mean a total loss to the apiary and in time ruin the entire beekeeping industry of the State. The 14 cases of disease found were not highly advanced and have been thoroughly treated and eliminated. During the coming season as many apiaries will be inspected as available funds will permit. This important inspection work, together with instruction, means that the industry will be greatly fostered and extended throughout the 96 counties of the State. It is due to these bacterial diseases, bee moth and poor management that many bee-

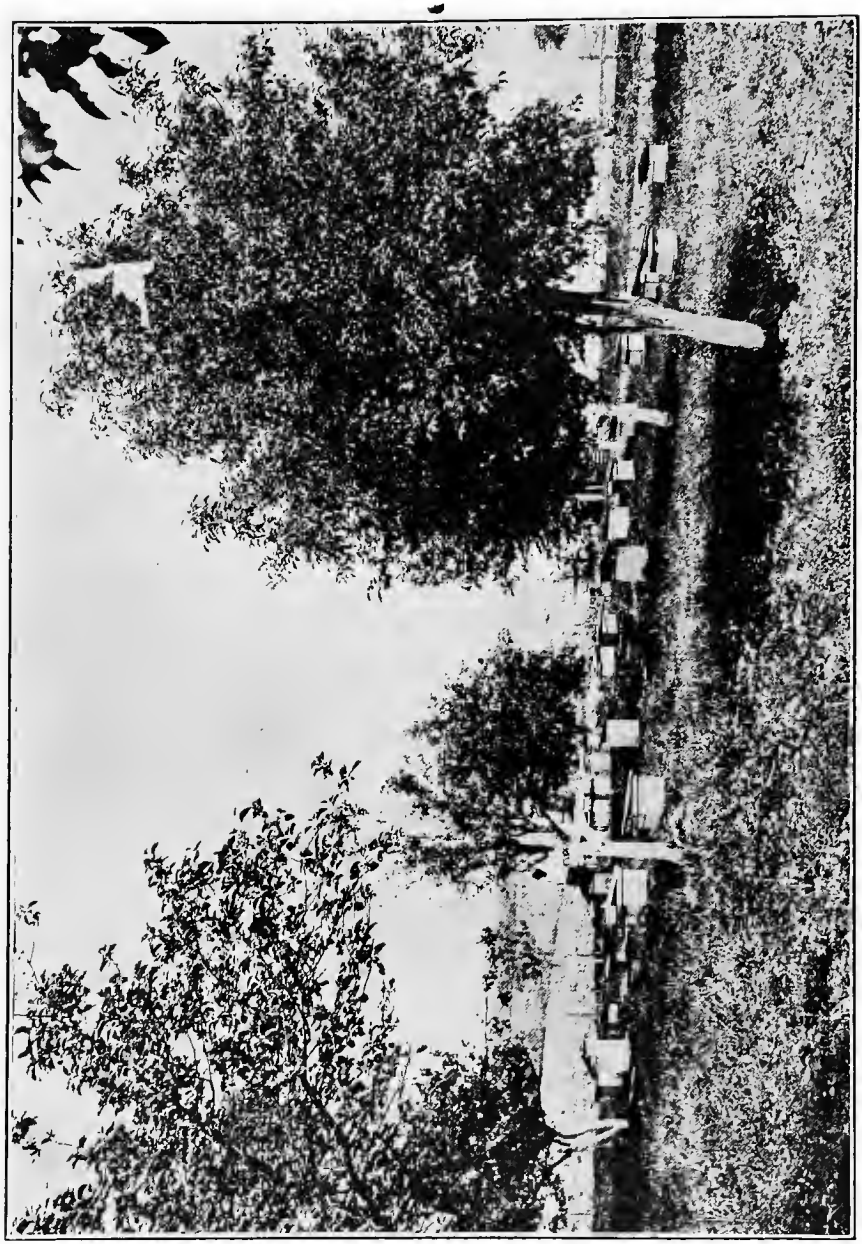


FIG. 41—BEEKEEPING WITH FRUIT GROWING

keepers in the past have found it impossible to keep their bees strong and healthy and to get greater yields of honey.

Tennessee as a beekeeping state

Many sections of Tennessee are admirably adapted to the keeping of bees, in that clover grows luxuriously. Leaving these regions we find the beekeepers producing honey profitably from poplar, linden, cotton, sourwood, aster, etc. The largest honey producers in the State, with very few exceptions, produce extract honey. The bulk of the honey produced is consumed in the State and large shipments are made to Tennessee from California and Texas. The possibilities of the beekeeping interests of the State are exceptionally good, they being not only fostered by State aid in the control of diseases, but also by instruction in the introduction of modern appliances and methods of management. As a rule the beekeepers are extending their business and this will continue to be enlarged as attention is directed to this industry. The beekeepers who will not give their bees care and attention and who still adhere to the log and plank "gums" will soon be forced out of business by bee troubles resulting from lack of attention, and in their place those making a study of the industry and using modern hives and appliances will push on to success. The market for honey throughout the State is exceptionally good. The writer has been surprised many times to find comb honey selling in the cities during holiday season for 35 and 40 cents per pound. The average price for extract honey in the State is from 12½ to 15 cents. In Texas, where the bulk of the honey is produced in the United States and where much of it is sold at wholesale, the average price is only 6 cents per pound.

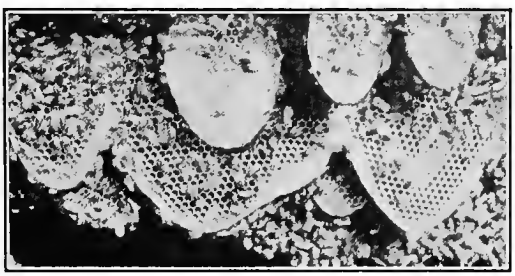


FIG. 42—NATURAL COMB BUILDING. A SUGGESTION ON THE USE OF FULL SHEETS OF FOUNDATION

(After Hutchinson)

Yields of different bees

More attention in the State is being paid to modern hives and the improved strains of bees than ever before. People are eager for information on the subject and scores of letters each month are sent to the Experiment Station and to this office for instructions. There are at present several firms in the State selling bee supplies, and besides, many agents are selling for outside firms. Few beekeepers today are keeping the black, or German bees. These have been exchanged for more gentle bees—the three-banded, and golden Italian and the Carniolians. *

The following table shows the number of beekeepers keeping Italian, Hybrid, or black (German) bees; also the yield of extract honey from each:

	No. of beekeepers	No. of colonies	Yield—Lbs.
Italian	93	2557	39½
Hybrid	30	691	30¼
Black (German)	34	561	20

Advantages for beekeeping in Tennessee

Some of the advantages of this State over the colder states are, that it is not necessary for the beekeepers in Tennessee to solve the wintering problem; the colonies keep well out of doors during the winter; the great number of growing days in the state make it possible for bees to gather honey as late as the latter part of November; the honey plants are varried, coming into bloom at different times of the year; and apiaries may be located in various parts of the State we find them on tops of mountains, in the valleys, and in the level sections. The map on page.... shows the location of the larger apiaries of the State.

Every inducement is offered to the energetic beekeeper who understands and loves the bees and is willing to make an effort to assist them in caring for their store of honey.

APIARY INSPECTION

In the spring of 1911 apiary inspection for the first time in Tennessee was undertaken. This inspection was made possible through an appropriation by Legislature of 1911 (Chapter 50, Acts of the Fifty-seventh General Assembly).

FIG. 43—INSPECTING THE BEES

The results of the initial work in apiary inspection are most .gratifying The beekeepers take kindly to the requirements and seem very willing to do all they can to cooperate and to extend the work. It is surprising to learn how very few of them are acquainted with the bee diseases, and, in fact, how few are giving their bees the proper care and attention. The problem of bettering the beekeeping interests is an educational one and it will be necessary to get public sentiment back of the requirement in order that a more liberal appropriation may be made for this important work. There are at present nearly 3,000 beekeepers having 10 colonies and more in the different parts of the State and the number of colonies of bees is 144,487. The task of inspection, therefore, is no small one, and with the present appropriation for the work only the larger apiaries and the salable queens can be carefully inspected. Not until more money is available for the protection of the beekeepers' interests can a full survey and a complete inspection be made. It is a fact that bee diseases and the bee moth are at the bottom of all the beekeepers' troubles, and in the effort to adjust these matters an educational campaign is as important as an apiary inspection. From the work thus far conducted it is evident that when once instructed the beekeepers will gladly take up the work and the prospects in honey producing will be even better than heretofore.

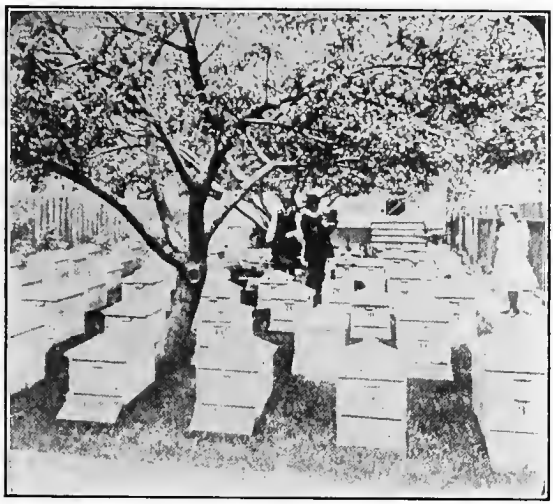


FIG. 44—A COMPACT APIARY ON CITY LOT

REPORT OF APIARY INSPECTION FOR 1911

The Department of Apiary Inspection, of the State Board of Entomology, was organized May 1, 1911, in accordance with Chapter 50 of the Acts of the 57th General Assembly.

During the season of 1911 in spections have been made in 70 apiaries, containing a total of about 800 colonies. The number of diseased apiaries found was 14. Number of colonies treated, 41. Colonies destroyed, none. American foul brood was located in Hamilton, Giles, Lawrence, Williamson, and Roane Counties, and European foul brood in Anderson, Montgomery, and Shelby Counties. Most of these cases have been cleaned up, and the bees are now in a healthy condition. However, a few reports of disease were received too late in the season to admit of successful treatment and these will be attended to in the early spring.

A card index has been prepared, containing the names and addresses of over 800 beekeepers in the State, together with the number of colonies, their condition, etc. This will be added to from time to time.

The honey crop for the past two seasons has been very light in some parts of the State, and the loss of bees during last winter was heavy. This was caused in most cases by starvation, although some of the loss was due to disease.

Respectfully submitted,

J. M. BUCHANAN,
State Inspector of Apiaries.

REPORT OF APIARY INSPECTION FOR 1912

I respectfully submit the following report of my duties as Inspector of Apiaries for the first six months of my commission:

My commission as Inspector of Apiaries for Tennessee was received June 6, 1912, and I at once entered upon my duties as such, in accordance with House Bill No. 70, Acts of 1911. Former Inspector, J. M. Buchanan, of Franklin, Tenn., turned over to me the names and addresses of about 800 Tennessee beekeepers that he had collected during his service. To each of those I mailed a copy of the Apiary Law and the following announcement of the change in the inspector:

"This announces the appointment of Dr. J. S. Ward as State Inspector of Apairies, to fill the vacancy lately made by the resignation of J. M. Buchanan, of Franklin, Tenn. Dr. Ward asks the cooperation of the beekeepers of the State in his efforts to protect the honey industry from the different bee diseases. Correspondence is solicited, and reports of bee diseasea will be given prompt attention."

The month of June was spent in doing inspection work, mostly in Davidson, Maury and Rutherford Counties. Only one yard was found infected with foul brood. This was given radical treatment, with satisfactory results. This month's inspection work, however, was without guidance so far as reports of diseases was concerned, and much of the time was used in giving instruction in the more approved methods of beekeeping.

Exhibition on agricultural train

The Tennessee Agriculture Train started on its tour over the State on July 1st. On July 4th the Chairman of the Tennessee Board of Entomology instructed me to join the train at Franklin, Tenn., with an apiary exhibit, and spend the months of July and August in an educational campaign in the interest of the beekeeping industry. The exhibit, being hastily prepared, was not as nearly complete as desired. It consisted, however, of observatory and working hives, with frames of foundation-drawn comb, division boards and queen excluder, extractor, an uncapping melter, smoker, veils, feeders, extracted and comb honey, specimens of Caucasian, German and Italian queens, and a good working colony of bees in an observatory hive, with super. This apiary exhibit, while small, proved one of the most attractive exhibits on the train. A working colony of bees in an observatory hive with glass sides, so the bees could be seen in their movements over the comb, was an interesting revelation to the thousands of people who passed through the train. Demonstrations and instructions in beekeeping were given in the car by the exhibit at every stop the train made throughout the State. In additiin to these demonstrations in the car, about 100 open-air lectures were given on beekeeping.

Literature on beekeeping as a practical and profitable industry was distributed until the supply was exhausted. Much interest was manifested in the modern methods of keeping bees, with many calls for bulletins, books and pamphlets of instruction.

The names and addresses of beekeepers and those interested in the honey industry were gathered at every stop the train made. These have been filed, both alphabetically and by counties, for ready reference and convenience in mailing out bulletins and other literature of instruction.

Need of education in beekeeping

While on the train we were particularly impressed with the need of education and instruction in beekeeping among beekeepers. Old and unprofitable methods should be discarded and all the practical methods should be taught, so as to enable the beekeepers to gather the tons and tons of honey that are going to waste every year. Thousands of acres of Tennessee soil are covered every spring with white clover blossoms, from which we get the finest of honey. This natural resource of wealth should not be allowed to go ungathered because of ignorance. According to the last census report issued by the Government, Tennessee ranked third in the number of hives or colonies, but only fifth in honey production. This low place in honey yield grows out of the fact that the majority of the 300,000 colonies in the State are kept in old-fashioned "gums" or homemade boxes, and cared for by impsactical and unprofitable methods. This is not as it should be, and your Inspector of Apiaries will exert himself to develop the industry through lectures, demonstrations and the mailing of bulletins, circulars and letters of instruction.

This educational work, however, will be much hampered by the present small appropriation. One thousand dollars falls far short of the amount needed to promote this industry. The annual income from honey and wax is only about $25,000, when the available natural resources are approximately $2,000,000.

The work on the Agricultural Train stopped September 1st. Inspection work was then resumed and continued until cold weather. Most of the work was done in Robertson, Williamson and Bedford Counties. The losses from diseased colonies in Bedford County were heavy. Whole apiaries were wiped out with black brood, and the beekeepers discouraged. Nearly two weeks were spent in this county treating colonies and giving instruction. At no place was my inspecton work resented. Every beekeeper was willing and ready to cooperate with me.

Lectures given

After advising with the Board of Entomology, a lantern outfit was purchased for giving illustrated lectures on Bee Culture during the winter months. Lectures with and without the lantern have been given during October, November and December, at the following places: Jackson, at the West Tennessee Farmers' Convention; Fairfield, Water Valley, Bellbuckle, Nashville, Capers, Egansville, Smyrna, Bethel, with two other engagements at Oakland and Dosset that failed. Sickness prevented a lecture at the Middle Tennessee Farmers Institute at Nashville.

Report of diseases

The number of reports of bee diseases have been disappointing. The fear of having their bees destroyed, or discouragement and indifference, or a lack of confidence in curative and preventive treatment, or ignorance of the Apiary Law, has made the beekeepers slow about reporting troubles.

After studying the conditions of the honey industry in Tennessee for these six months of my commission, I have outlined the following plan of work for the remaining winter months: First, to continue the lecturing; second, to obtain, as far as possible, the names of all the beekeepers in the State; third, to mail out literature on beekeeping; fourth, to invite cooperation and insist upon reports of bee diseases A tabulation of all reports will be kept and arranged for a vigorous inspection campaign in the early spring.

Very truly,

J. S. WARD,
Inspector of Apiaries.

THE TROUBLES OF THE BEEKEEPER

Information gained from blanks sent to the beekeepers throughout the State indicates that the chief troubles of the beekeeper are due to the bee moth. The table below gives the answers received from the largest beekeepers from different parts of the State:

Number of beekeepers reporting	Trouble
104	Bee moth
14	Paralysis
10	Foul brood
6	Ants
2	Roaches
2	Toads
1	Mice
1	Birds

The bee moth

When a beekeeper reports trouble from the bee moth it is a sure indication that carelessness is the seat of the trouble, for bee moth is a secondary trouble. Never does it attack a strong, vigorous colony. Only after the colony is weakened by loss of queen or foul brood does the moth gain entrance to the hive unless the hive is in very bad condition. One person reporting on these troubles said, "I am surprised that you ask concerning the bee moth. No modern beekeeper ever has trouble from this source." I might say that this reply came from one of Tennessee's best beekeepers and probably one of the largest producers of Italian queens in the United States. For those who have been unfortunate enough to have trouble from the bee moth a method for overcoming it may be suggested. The hive should be thoroughly cleaned. New foundation should be placed in the frames with a frame or two of comb taken from a strong hive. The bees which are left in the infected hive should be introduced into the new quarters. This colony should be carefully watched until it has regained normal strength. All of the old or infected comb should be burned and the hive should be thoroughly fumigated with carbon bisulphide or carefully charred by means of a plumber's blow lamp.

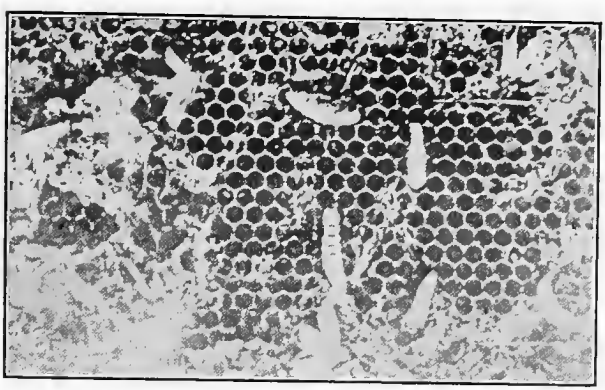


FIG. 45—THE BEE MOTH AND ITS WORK

Wax-worms

In combs or honey stored for sometime wax-worms frequently make their appearance. These may be controlled by putting comb and honey in a close room and carefully fumigating with sulphur fumes.

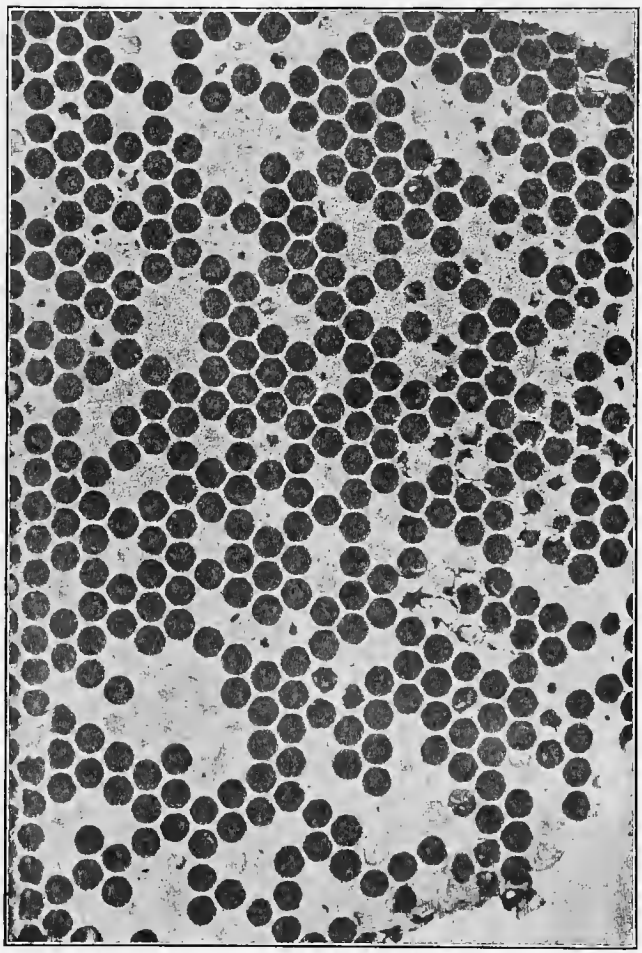


FIG. 45—COMB SHOWING ADVANCED STAGE OF AMERICAN FOUL BROOD
(after Cowan)

White ants, or Termites

Considerable trouble has been experienced in the experimental apiary with white ants honeycombing the legs of the bee stands. A very satisfactory remedy for this trouble is to soak the legs of the stand thoroughly in creosote.

Ants, roaches and spiders

Whenever trouble results from either of these sources one may conclude immediately that the colony is in a highly weakened condition and immediate attention is demanded. No other remedy is necessary than to get the colony strong.

Birds

Bee martins will frequent an apiary from time to time and destroy a considerable number of bees. They seem to be partial to young queens and have caused the queen breeders appreciable loss. A little care, however, will induce this bird to leave. Shooting at the bird, not trying to kill it, has given success.

American foul brood

The cause of American foul brood is now known to be a microscopic organism called *Bacillus larvae* White. Dr. E. F. Phillips, in charge of apicultural investigations of the U. S. Department of Agriculture, describes this disease as follows:

"When the larvae are first affected they turn to a light chocolate color and in the advanced stages of decay become darker, resembling roasted coffee in color. Usually the larvae are attacked at about the time of capping, and most of the cells containing infected larvae are capped. As decay proceeds, these cappings become sunken and perforated, and, as the healthy brood emerges, the comb shows the scattered cells containing larvae which have died of disease, still capped. The most noticeable characteristic of this infection is the fact that when a small stick is inserted in a larvae which has died of the disease, and then slowly removed, the broken-down tissues adhere to it and will often stretch out for several inches before breaking. When the larva dries, it forms a dark brown color, which can best be observed when the comb is held so that a bright light strikes the lower side wall of the cell. Decaying larvae which have died of this disease have a very characteristic odor, which resembles a poor quality of glue. The disease seldom attacks drone or queen larvae." *

Dr. Phillips describes the European foul brood as follows:

European foul brood.

"This disease attacks larvae earlier than does American foul brood, and a comparatively small percentage of the diseased brood is ever capped. The diseased larvae which are capped over have sunken and perforated cappings. The larvae when first attacked show a small yellow spot on the body near the head and move uneasily in the cell. When death occurs they turn yellow, then brown, and finally almost black. Decaying larvae which have died of this disease do not usually stretch out in a long thread when a small stick is inserted and slowly removed. Occasionally there is a very slight 'ropiness,' but this is never very marked. The thoroughly dried larvae form irregular scales, which are not strongly adherent to the lower side wall of the cell. There is very little odor from decaying larvae which have died from this disease, and when an odor is noticeable it is not the 'glue-pot' odor of the American foul brood, but more nearly resembles that of soured dead brood. This disease attacks drone and queen larvae very soon after the colony is infected. It is as a rule much more infectious

*The Brood Diseases of Bees, by E. F. Phillips, Ph. D. Circular 79, Bureau of Entomology, U. S. Department of Agriculture, pp. 1-2, 1906.

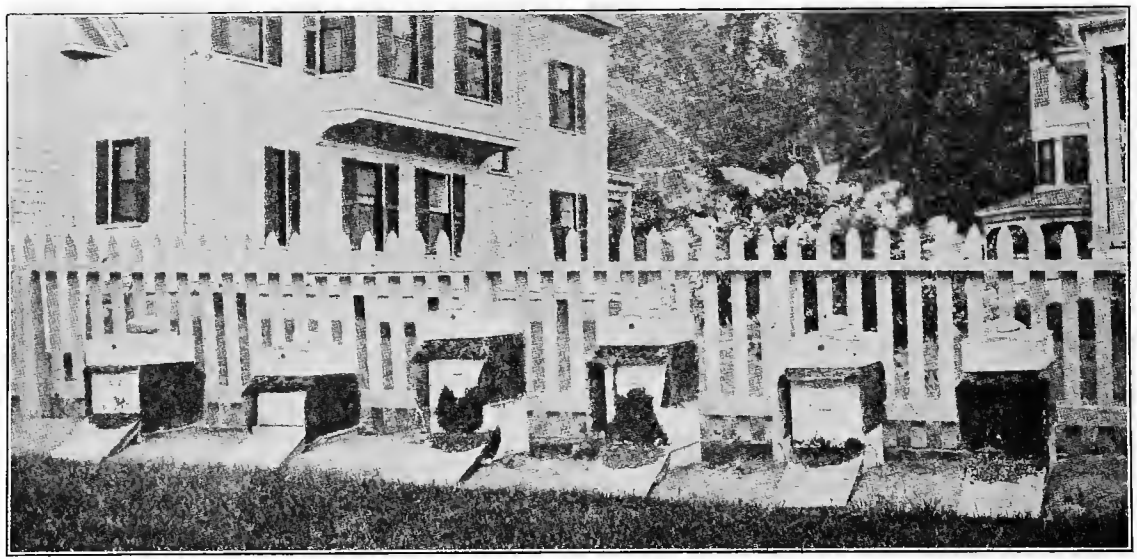


FIG. 47—COLONIES INFECTED WITH FOUL BROOD

than American foul brood and spreads more rapidly. On the other hand, it sometimes happens that the disease will disappear of its own accord, a thing which the author never knew to occur in a genuine case of American foul brood. European foul brood is most destructive during the spring and early summer, often almost disappearing in late summer and autumn."

If taken in time, both of these diseases may be controlled without serious loss to the beekeeper, but if allowed to go unchecked they will soon ruin any apiary, great or small.

The basis of treatment of both diseases is to deprive the infected colonies of all combs, whether empty or containing brood or honey, the bees being put into a new or thoroughly disinfected hive and allowed to start housekeeping anew. It will be from four to six days before they have any young to feed, and by that time all the honey they had in their honey sacs when taken from their infected hive will be gone, and the young will receive pure food, fresh from the flowers.

Except in fairly large apiaries, it is not worth while trying to save any of the brood from infected colonies. When it is desired to save such brood, it should all be given to one or two diseased colonies and allowed to remain for two or three weeks, after which these colonies should also be treated. In transferring diseased brood it is best to put it above a queen-excluding honeyboard, so that the queen of the colony may not lay eggs in the diseased combs. It is not wise to dequeen such colonies, for colonies without a queen are less likely to keep out robbers, and if robbers gain access to the infected honey the disease will then appear in the colonies to which they belong. The combs from diseased colonies may be melted and the wax recovered, and wax from such sources appears to be safe to use in foundation-making, etc. The refuse from the combs should be burned. The honey as a rule is not worth trying to save. It is difficult to sterilize, and its return to the bees for food is most unwise. If it is clear, its use as human food is all right, for the microscopic plants are harmless to the human system. But do not let a single drop of it get to the bees.

The frames from diseased colonies may be saved by being immersed for a few minutes in a very strong solution of washing soda that is kept boiling during the operation. As soon as all wax and bee glue (propolis) are dissolved from the frames, they are rinsed in clear water, and after drying are ready for use again. Hive bodies, floors, covers, and other parts may be similarly treated, but usually it is easier to scorch these over with a gasoline torch, or by some similar method. *

Pickled brood

The larvae affected with pickled brood die just preceding or just after capping and usually present a watery appearance. The cause is not known and the disease does not seem to be infectious.

It is usually treated by requeening, on the assumption that it is congenital.

Diseases of adult bees

Paralysis is a disease of the adult bee. Its cause is not known and it is not common in the Northern States.

Diarrhoea, or dysentery, as it is often called, is more properly a temporary digestive disturbance than a disease. It

*The following information from G. F. White, given in Circular 157, U. S. Department of Agriculture, Bureau of Entomology, concerning the brood diseases: "There are, then, three principal brood diseases. Two of these—American foul brood, caused by Bacillus larvae, and European foul brood, caused by Bacillus pluton—are known to be infectious. From these two diseases there must be differentiated the third one, an apparently noninfectious disorder, the so-called 'pickled brood.' Larvae dead of this latter disease are practically free from microorganisms. The exciting cause of this disorder is not yet known."

most frequently follows confinement to the hives for an undue length of time and under unfavorable conditions. Bees maintain the heat necessary for life by the consumption of honey. When the honey is deficient or low in the natural sugars, as when it is thin and unripe, or contains honeydew or an excess of pollen, they have to consume an undue amount to keep up the normal heat, and the system becomes overloaded with waste matter. Unless the weather permits the bees to fly occasionally, the matter is voided in the hives and the trouble is aggravated.

Leaky or insufficiently ventilated hives will cause the bees extra effort to keep warm and so bring about the trouble, even though the honey is perfect for their purpose. A warm, sunny day will usually cure the trouble, but if combs are badly soiled, it may be necessary to give the bees a clean set of combs and a clean hive and feed them some warm sugar-syrup.

Moderate spotting of hives when bees fly in winter and spring need cause no alarm, but if the trouble seems excessive about any particular hive, it had better be opened and examined.

Sacbrood

Sacbrood is one of the diseases of bees which has been frequently mistaken for "pickled brood," but the difference between the two diseases are distinct. As described pickled brood is a fungous disease which attacks not only the larvae but also the pupae and the adult bees. According to Circular 169, issued January 13, 1913, by the U. S. Department of Agriculture, Bureau of Entomology, samples of sacbrood have been received from all of the states except three, while no samples have been received of bees affected by a fungous disease.

Mention here is made of the sacbrood for there are several indications of this disease in Tennessee. The following full description is given in Circular 169, above referred to:

A disease of the brood which is not foul brood

"There is a disease of the brood of bees that has attracted considerable attention among beekeepers that is neither American foul brood, European foul brood, pickled brood, chilled brood, nor starved brood. This disorder of the brood has for many years been recognized by beekeepers as being different from foul brood. Doolittle, of America, in 1881, wrote of a disease which he says is similar to and called foul brood, but which is not foul brood. He writes that larvae die here and there throughout the comb and that the disease may disappear entirely or it may reappear the next season. Jones, of Canada, 1883, wrote also of a disease which results in a dying of the brood, with appearances similar to foul brood; but he states that the disease is not foul brood. He says that the bees frequently remove the dead brood and that no further trouble ensues. Simmins, of England, in 1887, wrote of dead brood which he says is not foul brood and describes the difference in appearance between the brood dead of the disease and brood dead of foul brood. He states, furthermore, that the condition is different from chilled brood and that Cheshire did not find any microscopic evidence of disease in larvae dead of the disease. An editorial in one of the bee journals in 1892 is of particular interest at this point. The editor wrote that he had recently encountered dead brood which did not seem to be infectious and which lacked two decisive symptoms of the real foul brood, viz.: the ropiness and the glue-pot odor.

"My own study of this dead brood, recognized by the beekeepers as being different from the foul brood, was begun in 1902. Eight samples labeled 'pickled brood' were received from the bee inspectors of New York State during 1902 and 1903. These samples were examined and were found to be practically free from microorganisms. The result of these examinations were published in January, 1904. Burri, of Switzerland, in 1906, reported the results of the examination of 25 samples of brood material thought by the beekeepers to be diseased. He placed the results of his examinations under the following headings: 'Sour brood,' 'stinking foul brood,' 'nonstinking foul brood,' and 'dead brood free from bacteria.' Four of the 25 samples examined contained dead brood free from bacteria and unaccompanied by other diseases. Kursteiner, of Switzerland, in 1910, in classifying the results obtained from samples examined by him made the same classification as made by Burri. During the past six years 362 samples of this disease have been received by the Bureau of Entomology and diagnosed in its bacteriological laboratory.

"There is, therefore, a disorder attacking the brood of bees in which brood dies, but in which there has not been demonstrated any microorganism to which the cause of the trouble could be attributed. For this disease the name of "sacbrood" is here suggested.

The name "sacbrood"

"As stated, my first examination of this dead brood was made in 1902, when samples were received diagnosed by beekeepers as 'pickled brood.' The fact was easily determined at that time that the disease could not be considered a fungous disease and was, therefore, not pickled brood. In the past my preference has been to refer to this condition only as the 'so-called pickled brood.' Since the disease is not pickled brood, it will produce less confusion and be more scientific if the term 'pickled brood' be entirely omitted in the name for the disease. Many larvae dead of this disease can be removed from the cell without rupturing their body wall. When thus removed they have the appearance of a small closed sac. This character suggested the name 'sacbrood.' The name has the virtue, therefore, of being both appropriate and brief.

The symptoms of sacbrood

"The strength of a colony in which sacbrood is present is frequently not noticeably diminished. When the brood is badly infected, however, the colony naturally becomes appreciably weakened thereby. The brood dies after the time of capping. The dead larvae are, therefore, almost always found extended lengthwise in the cell and lying with the dorsal side against the lower wall. It is not unusual to find many larvae dead of this disease in uncapped cells. Such brood, however, had been uncapped by the bees after it died. In this disease the cappings are frequently punctured by the bees. Occasionally a capping has a hole through it indicating that the capping itself had never been completed. A larvae dead of this disease loses its normal color and assumes at first a slightly yellowish tint. 'Brown' is the most characteristic appearance assumed by the larvae during its decay. Various shades are observed. The term 'gray' might sometimes appropriately be used to designate it. The form of the larvae dead of this disease changes much less than it does in foul brood. The body wall is not easily broken as a rule. On this account often the entire larvae can be removed from the cell intact. The content of this sacklike larva is more or less watery. The head end is usually turned markedly upward. The dried larva or scale is easily removed from the lower side wall. There is practically no odor to the brood combs.

The infectious nature and cause of sacbrood

"In the study of samples of this disease received directly from beekeepers no microorganisms have been found, either culturally or microscopically, to which the cause of the disease can be attributed. This fact, together with the fact that the disease often disappears without any great loss to the colony, would tend to indicate that the disease is not infectious. The experimental evidence which I have obtained proves, however, that the disease is infectious."

FILE A REQUEST OF INSPECTION FOR YOUR BEES

We would like to encourage all beekeepers of Tennessee to report any trouble which their bees may experience, and remedies if known will be given. If there is any indications of foul brood or sacbrood being present write to the State Board of Entomology, Knoxville, Tenn., and arrangements will be made as soon as possible for the Apiary Inspector to inspect your apiary without expense or inconvenience to you.

FIG. 48—GENTLE BEES AND CLOSE INSPECTION TWO OF THE SECRETS OF SUCCESSFUL BEEKEEPING

APIARY LAW

Chapter 50, Acts of 1911

House Bill No. 70

AN ACT to suppress infectious and contagious diseases of bees; to provide for an inspector of apiaries, to define his powers and duties, and to define certain misdemeanors and provide punishment therefor.

Supervision of State Board of Entomology

Section 1. **Be it enacted by the General Assembly of the State of Tennessee,** That within thirty days from the passage of this Act, the Commissioner of Agriculture shall appoint a duly qualified and competent Inspector of Apiaries whose duties it shall be to inspect the bees of the State, as prescribed in this Act; and such Inspector of Apiaries shall act under the authority and supervision of the State Board of Entomology.

Inspections

Sec. 2. **Be it further enacted,** That upon receiving information from any source, of the existence of disease in any apiary in the State, the Inspector of Apiaries shall examine such apiary, and all others in the same locality, and shall ascertain whether or not the disease known as Foul Brood, or any other disease which is infectious or contagious in its nature, and injurious to honey bees, exists in such apiaries and shall designate each colony and apiary which he finds infected, and shall notify the owner or person in charge of such bees thereof; and the owner or person in charge of such bees shall at once practically and in good faith, apply, and thereafter fully carry out upon such diseased bees, such treatment, as may have been prescribed by the Inspector for such cases; and shall also thoroughly disinfect, to the satisfaction of the Inspector, all bee hives, combs, honey and apparatus used in connection with such diseased bees; or the said owner or person in charge may, at his election, utterly destroy by fire all such infected bees, hives, combs, honey and apparatus.

Authority of Inspector

Sec. 3. **Be it further enacted,** That the Inspector of Apiaries or his deputy or assistant shall have the right to enter the premises of any beekeeper where bees are kept, and inspect such bees, and any person resisting or refusing to allow such inspection, shall be guilty of a misdemeanor, and upon conviction, shall be punished by a fine of not less than five dollars nor more than twenty-five dollars.

Treatment of Diseased Apiaries

Sec. 4. **Be it further enacted,** That any owner or keeper of bees who shall be notified by the Inspector of Apiaries, that Foul Brood or any other infectious or contagious disease exists in any of the hives in his apiary, and who shall within ten days from the time of receiving such notification fail or refuse to treat or destroy such bees, hives, combs, or appliances, shall be guilty of a misdemeanor, and upon conviction, shall be punished by a fine of not less than five dollars, nor more than twenty-five dollars.

Sale of Infected Bees

Sec. 5. **Be it further enacted,** That any person who shall knowingly sell, give away, or offer for sale, or who shall expose in his apiary or elsewhere, any infected bees, hives, combs, honey or other infected thing, or shall conceal the fact that Foul Brood or other

disease exists in his apiary, shall be guilty of a misdemeanor, and upon conviction, shall be punished by a fine of not less than five dollars nor more than twenty-five dollars.

Transfer of Diseased Bees

Sec. 6. **Be it further enacted,** That the Inspector of Apiaries shall have full power, in his discretion, to order any owner or keeper of bees, dwelling in box hives, in apiaries where disease exists, to transfer such bees to movable frame hives within a specified time, and in default of such transfer, the Inspector, may order the destruction of such box-hives and the bees dwelling therein.

Certificates Required on Bees Coming into Tennessee

Sec. 7. **Be it further enacted,** That any person, firm or corporation who shall bring into the State of Tennessee, any colony or colonies of bees, shall immediately notify the Inspector of Apiaries of such fact, stating where such bees are being kept, and shall at the same time file with the said Inspector a certificate from the duly appointed Inspector in the County or State from which such bees were shipped, stating that such colony or colonies are free from any infectious or contagious disease; and in default of such certificate it shall be the duty of the Inspector of Apiaries to proceed to examine such bees, and ascertain whether they are free from Foul Brood or other disease. Any person, firm, or corporation who shall fail to notify the Inspector as required by this Section, for a period of ten days from the arrival within the State of Tennessee of such colony or colonies of bees, shall be guilty of a misdemeanor, and upon conviction, shall be punished by a fine of not less than five dollars nor more than twenty-five dollars.

Inspection Required of Queen Bees

Sec. 8. **Be it further enacted,** That any person, firm or corporation, engaged in the rearing of queen bees for sale, to use honey for the making of candy for use in mailing cages, which has been boiled for at least thirty minutes. Any person so engaged in the rearing of queen bees shall have his apiary or apiaries inspected at least twice during each summer season, and upon the discovery of any disease which is infectious or contagious in its nature, and injurious to bees, said person shall at once cease to ship queen bees from such diseased apiary until the Inspector of apiaries shall declare the said apiary free from any disease. Any queen breeder who shall violate the provisions of this section shall be guilty of a misdemeanor, and upon conviction, shall be punished by a fine of not less than five dollars nor more than twenty-five dollars.

Precautions of Inspector

Sec. 9. **Be it further enacted,** That the Inspector, after inspecting infected bees, or handling infected hives or fixtures, shall, before proceeding to any other apiary, thoroughly disinfect any portion of his person or clothing or any tools used by him which have come in contact with any infected material.

Report of Inspector

Sec. 10. **Be it further enacted,** That the Inspector of Apiaries shall make an annual report to the Commissioner of Agriculture giving the number of apiaries inspected, the number of diseased apiaries found, the number of colonies treated, and the number of colonies destroyed, and statistics bearing on the bee industry.

Salary of Inspector

Sec. 11. **Be it further enacted,** That the Inspector of Apiaries shall receive a salary of five hundred dollars per annum, together with all necessary expenses while actually engaged in performing his duties under the provisions of this Act, provided such salary and expenses shall not exceed one thousand dollars per annum.

Appropriation to State Board of Entomology

Sec. 12. **Be it further enacted,** That the sum of one thousand dollars annually be, and is hereby appropriated to the State Board of Entomology, in order to carry out the provisions of this Act.

Comptroller to Draw Warrant

Sec. 13. **Be it further enacted,** That the Comptroller of the State be, and is hereby authorized to issue his warrant upon the State Treasurer for the sum of one thousand dollars annually, out of any funds not otherwise appropriated; that said sum shall be made payable quarterly to the State Board of Entomology upon the presentation of the proper vouchers.

Sec. 14. **Be it further enacted,** That this Act shall take effect from and after its passage, the public welfare requiring it, and that all laws and parts of laws in conflict with this Act are hereby repealed.

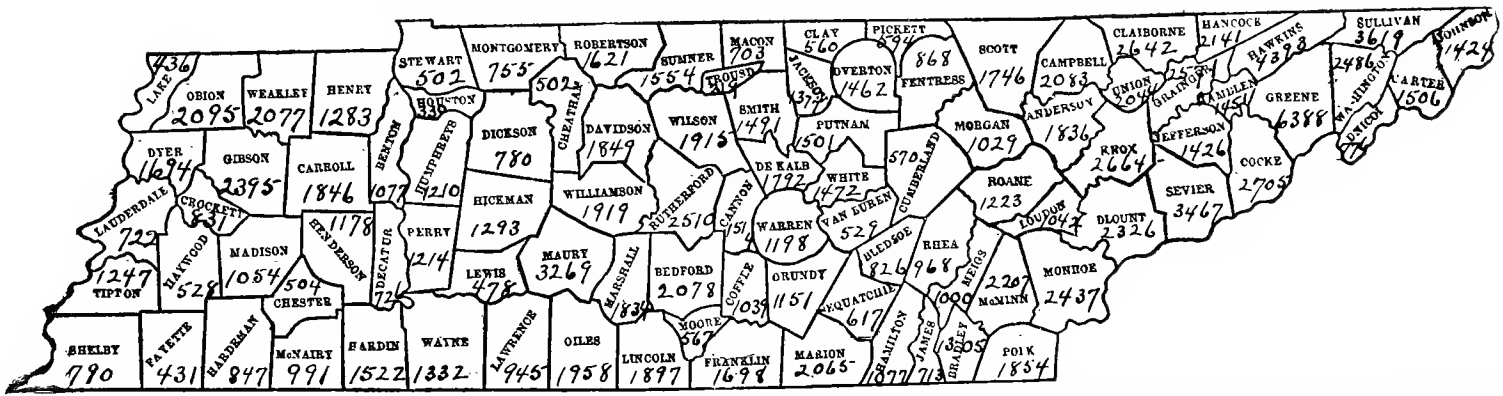
Passed April 6, 1911. Approved April 19, 1911.

STATE BEEKEEPERS' ASSOCIATION

Instruction in beekeeping

After the State Board of Entomology had sent out some 2000 blanks relative to the beekeeping interests of the State, nearly all of which were carefully filled out and returned, it was very evident that the State was well adapted to beekeeping and that the beekeepers were very desirous of information on modern beekeeping. Consequently, in 1906 there was started, for the first time in Tennessee, a course in beekeeping. This was given at the University in connection with the Agricultural Short Course. Several students, both men and women, from different parts of the State attended regularly this course. From the interest taken and the enthusiasm shown it was conclusive that with very little effort a large class in beekeeping would be possible. In 1907 a course in beekeeping was continued with a better attendance and increased facility for developing the practical side of the work. This year prizes were offered for two of the best essays entitled "The Value of the Honey Bee to the Farmer." Prizes were offered by queen breeders and manufacturers of beekeepers' supplies. This feature, together with several talks by practical beekeepers, were features which meant much to the course. In 1908 the course in beekeeping was given for the third year, in connection with the Agricultural Short Course. The number of students registered for the work was 27, representing both sexes, from different parts of the State. Prizes were again offered this year for the best essay on "Why Beekeeping Should be Encouraged in Tennessee." Lantern slide views, charts, models, a full line of beekeeping equipment, with practical talks illustrated by free-hand sketches, featured the course, adding both simplicity and practical importance. The afternoons during the course were devoted to practice in constructing hives and putting together hive parts, placing foundation in brood and super frames, also sections, in making syrups for fall and spring feeding. Several afternoons were profitably spent in visiting apiaries in proximity to Knoxville.

COLONIES OF HONEY BEES IN THE COUNTIES OF TENNESSEE



MAP 2—SHOWING LOCATION OF THE 144,487 COLONIES OF BEES IN TENNESSEE, VALUED AT $3.50 PER COLONY GIVES A VALUATION OF $505,704.5[illegible] SWARMS FROM ½ THE TOTAL NUMBER OF COLONIES, VALUED AT $72,243.50. THE AVERAGE YIELD OF HONEY PER COLONY IS 39½ POUN[illegible] OR 5,707,236½ POUNDS OF HONEY VALUED AT 15 CENTS PER POUND AGGREGATES $856,085.48.

COURSE IN BEE CULTURE AT UNIVERSITY OF TENNESSEE

Dates	Wednesday Jan. 30 Feb. 6	Thursday Jan. 31 Feb. 7	Friday Feb. 1 Feb. 8	Saturday Feb. 2 Feb. 9	Monday Feb. 4 Feb. 10	Tuesday Feb. 5 Feb. 11
Hours 8-9	1. Introduction, Scope, etc.	1. Typss of Bees	1. Hives	1. Apparatus and Equipment.	1. Transferring,	1. Queen Rearing (Essay to be handed in)
	2. Hiving	2. Bee Pasturage	2. Care of Honey	2. Marketing Honey	2. Diseases of bees	2. Why keep bees?
9-10	1. Life history and habits . 2. Kind of bee plants. Culture of bee plants.	1. Types of bees. 2. Harvesting honey —kinds of honey.	1. Hives 2. Extracting honey. Grading honey for market.	1. Apparatus and equipment. 2. Wintering bees.	1. Feeding. 2. Diseases of bees.	1. Queen rearing. 2. Do bees injure fruit?
10-11						
11-12	1. Types of bees. 2. Culture of bee plants.	1. Establish and managing an Apiary (location) 2. Honey as food.	1. Honey houses. 2. Cartoning and packing.	1. Handling bees. 2. Diseases of bees.	1. Breeding. 2. Enemies of bees.	1. Prevention of swarming. 2. Value of a State Beekeepers' Association.
12-2			DINNER			
2-5	1. Practical work with bees in Apiary. 2. Grading honey.	1. Visit to large out Apiary. 2. Use of extractors (honey and wax)	1. Demonstration of hives and their parts. 2. Studying bee plants.	1. Practice at setting foundation. 2. Work in Apiary.	1. Handling bees 2. Visit to ont Apiary	1. Practical work with bees. 2. Practical work in Apiary.

History of the State Beekeepers' Association

At the close of this third successful session many of the practical beekeepers and attendants became interested in forming a State beekeepers' association. Many letters were written to beekeepers in the different parts of the State and on the last day of the course in beekeeping a meeting was held for the purpose of forming an association. Many talks were made in favor of an association and letters read from absent members. As result of a motion that a State beekeepers' association be formed the vote was unanimous, and the following officers were elected: President G. M. Bentley, Knoxville; Vice-President, Jno. M. Davis, Spring Hill; Secretary-Treasurer, Edward S. Ezell, Church Hill.

Dues of the Association were fixed and a committee appointed to draw up a constitution and by-laws. In the spring of 1909 the secretary of the Central Tennessee Beekeepers' Association, an organization recently formed by the beekeepers of Davidson, Wilson and Williamson Counties, asked for suggestions in regard to the blending of the two associations. This was deemed advisable by both officers and members of the two associations and the Tennessee Beekeepers' Association was the result. The organization is in a very prosperous condition, having over 100 members. Meetings are held several times during the year at Nashville. For the past two years the January meeting has been held in conjunction with the three-days annual meetings of the State nurserymen and fruitgrowers.

Following is the program: The accompanying figure shows those in attendance at the January (1913) meeting.

Annual Convention of the State Beekeepers' Association 1913

The Tennessee Beekeepers' Association held its annual convention, Friday, January 31, at the Maxwell House, Nashville, sessions being held both morning and afternoon. A number of interesting addresses, lectures, and discussions were made, affording a great deal of general and specific information to the members present, and several matters of routine business were transacted.

The officers elected for the ensuing year were as follows: President, Jno. M. Davis, Spring Hill; Vice-President, N. O. Walker, Franklin; Secretary-Treasurer, J. M. Buchanan, Franklin.

The annual address was delivered by the President W. M. Joseph, of Nashville. He reviewed the progress of the Association, and outlined the things for which the organization stands. He also devoted some time to his views on certain problems facing beekeepers. He was followed by Porter Ward, of Elkton, Ky., who spoke on "Does Beekeeping Pay?" He answered this question with an emphatic affirmative, saying that few professions or lines of business afford greater profits from the capital used, always provided that modern methods and equipment are used.

A discussion of the Pure Food Laws as applying to the sale of honey was carried on by several members, it being stated that these laws are good and quite adequate, but that honest beekeepers should be constantly on the lookout for violators.

An interesting stereopticon lecture on "Tennessee Beekeeping" was made by Dr. J. S. Ward, of Nashville, State Apiary Inspector. He showed lantern slides illustrating hive conditions in this State as he found them in pursuing his official work as Inspector. He made a number of optimistic remarks on the outlook for the beekeepers in Tennessee, and pointed out a number of good, new methods applying to the business.

The afternoon session began with an address by G. M. Bentley, of Knoxville, on "The Apiary Inspectors' Meeting at Cleveland, Ohio."

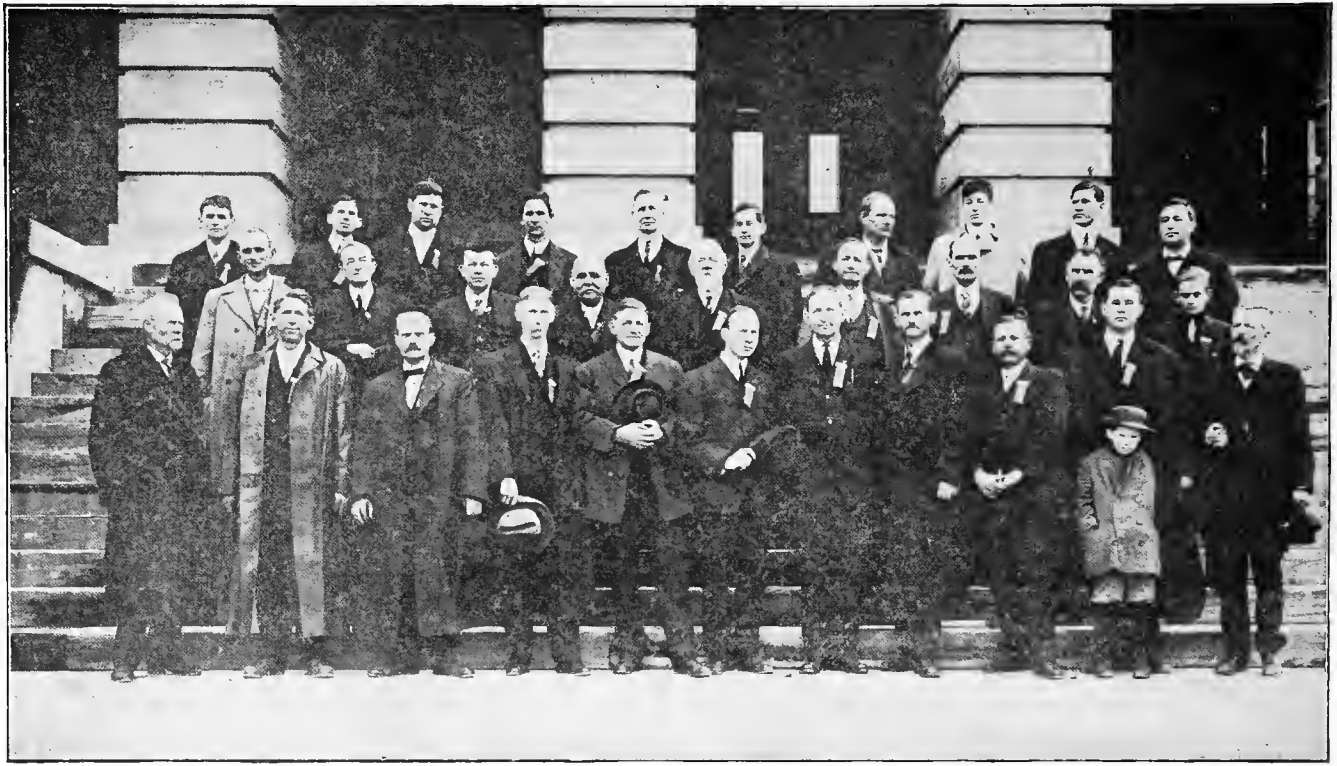


FIG. 49—TENNESSEE BEEKEEPERS' ASSOCIATION, NASHVILLE, TENN., JANUARY 31, 1913

This meeting was held last December; the report gave a number of interesting excerpts from the transactions of the Convention.

Dr. L. E. Webb, of St. Bethlehem, made a short talk on "The Pleasures of Beekeeping," and delighted the audience with his skilled method of handling the subject. He showed that the business can be made a very profitable one, and that it is also one from which many pleasures can be derived. He dwelt on the life and habits of bees, showing the interesting features connected with them.

RELATION OF BEEKEEPING TO HORTICULTURE

Paper read before the State Horticultural Society by Dr. J. S. Ward

Outside of the beekeeping world the great majority of people think that the only benefit humanity receives from bees is the production of honey and wax. It is not generally known nor even understood that bees were created not so much for the purpose of gathering the delicious sweet for mankind, as for carrying the pollen grains from one flower to another, so that these may bear fruit and seed. The real economical value of the bees is to be found in the work of fertilizing

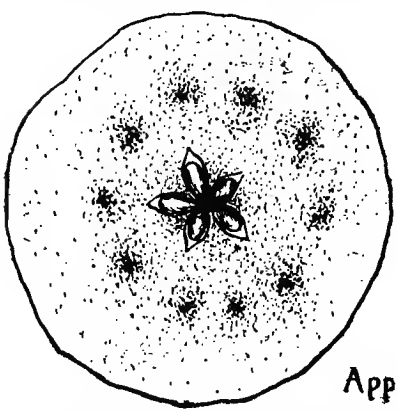


FIG. 51—PERFECT POLLINATION

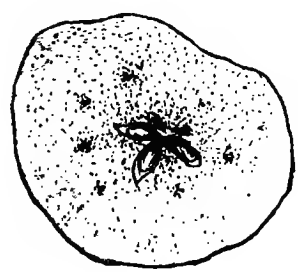
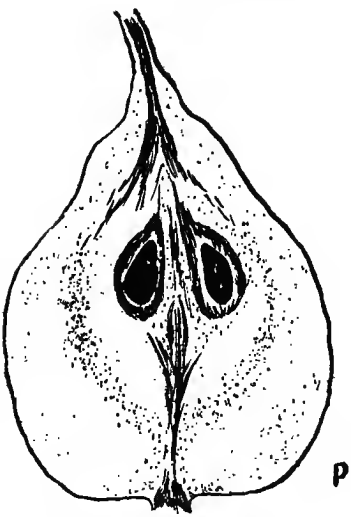


FIG. 52—IMPERFECT POLLINATION

and cross-fertilizing seed and fruit-bearing plants so valuable to man; the honey and wax is secondary.

Comparative anatomy and physiology between animal and plant life is one of nature's most interesting studies. Animals have a skeleton, so does the tree in its cellulose tissue; animals have a skin, so does vegetation in its bark; animals have a circulation, lungs, and digestive ferments; the tree presents corresponding organs and functions in the flow of its sap, in the respiration and transpiration of its leaves and in the digestive function of its diastase ferment. Stronger still is the analogy when we come to the study of the anatomy and physiology of the generative organs. The sex organs exist in plants and flowers very much as in animals, and fertilization before fruitage is as absolute in one as in the other. In some species the male and female organs are found on different plants, as in the mulberry; again, these organs will be found in different flowers on the same growth, as in the common rag weed, also sometimes called bitter weed, or hog weed. Here the stamens and pistils occupy two distinct and entirely unlike flower. Common corn is another example of this class of plants that bears

the sex organs in different flowers on the same growth. In the great majority of instances both organs are found in the same flower. No matter what the arrangement may be it is absolutely necessary that the pollen grains from the anther or the male part of the blossom reach the pistil, the female part of another. In some flowers the anther reach maturity and throw out the pollen before the seed chamber is developed or the stigmas receptive. In the willow bush we find a good example of this condition. In other plants the pistils mature before the anthers ripen as in the common figwort and the horse chestnut. Again we have flowers whose anthers and pistils mature at the same time, but because of their relative position self-fertilization is impossible. Other arrangements might be mentioned showing the impossibility of self-fertilization and nature's demand for cross-breeding. All of this also tends to confirm the popular belief in the danger of close in-breeding in animals as well as in plants and the desirability of cross-breeding in stock and cross-fertilization in plant life.



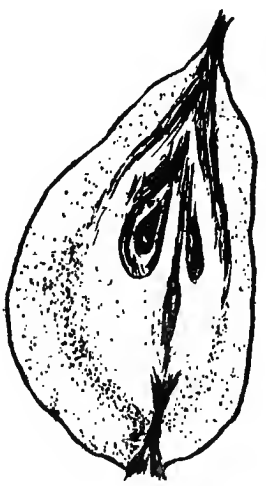


FIG. 53—PERFECT POLLINATION FIG. 54—IMPERFECT POLLINATION

A German writer by the name of Sprengel published a book in 1793 on "The Secret of Nature in the Form and Fertilization of Flowers Discovered," in which he claimed the independent creation of species through self-fertilization. Later on other investigators reached different conclusions; among them was Andrew Knight, whose experiments proved to him that in no plant does self-fertilization occur for an unlimited number of generations. It was not until after the appearance of Darwin's "Origin of Species" that Knight's theory was emphasized in a general law of nature. In Darwin's second work, entitled "Various Contrivances by Which British and Foreign Orchids Are Fertilized by Insects," he sums up his work by stating that "Nature abhors perpetual self-fertilization."

The pollination or fertilization of plants is brought about in two ways: first, by the wind; second, by insects. Plants whose flowers are small and inconspicuous, as the willows, pines, oaks and birches,

have very light and dry pollen, which in favorable weather may be blown about and pollinate many flowers, but often the wind is ineffective on account of the pollens being sticky by reason of moisture in the air in the form of rain, heavy dew or fog. Most of the flowers, however, are not of the "wind-bearing" type and require some other agents than the wind to carry the pollen, and these agents are the insects. Insects go from flower to flower gathering pollen or nectar for food, and in crawling over the stamens and pistils they get their little bodies covered with the pollen grains and easily, effectively transfer them to the stigmas of other blossoms, resulting also in the cross-fertilization that nature demads. Observation and experiments teach that without insects there is but little pollination and without pollination the blossoms with their pistils wither and die without fruitage.

Muller in his investigations found that in Germany 2,750 out of 6,231 visits of insects to flowers were made by the Hymenoptera, and of this number (3,481) more than half (2,191) were made by the **Apidae**, the family to which the honey bee belongs. Waite, in his bulletin on "The Pollination of Pear Flowers" (Bul. 5, Div. of Veg. Pathology, U. S. Dept. Agr.) after mentioning a large number of species of insects which visit pear blossoms, says: "The common honey bee is the most regular and important abundant visitor, and probably does more good than any other species."

FIG. 55—BEES CARRYING POLLEN

The bees need protein as well as carbohydrates to make a well-balanced ration for the young growing insects. The honey, which contains the saccharin or carbohydrates, is stored in large quantities, but the pollen, which contains the protein material, is not stored in any appreciable quantity; it is practically gathered from day to day. Nature thus compels the bees to use every opportunity to gather pollen for the maintenance of the colony—for self-preservation, and thereby inducing them to pollinate the blossoms, which would otherwise be unproductive.

Dr. Fletcher, in a paper read before the Ontario Association of Beekeepers, said: "It can be shown that, owing to its size, weight, and habits, no insect is so well calculated to insure the fertilization of fruit blossoms as the honeybee, which flies rapidly from plant to plant, and, by running over the flowers in search of pollen or nectar, brushes off the pollen and carries this vitalizing element on the hairs of its body to the next flower visited."

Dr Phillips says: "While the honey bee is, perhaps, not better equipped than other insects, especially other bees, for carrying pollen, there is one respect in which it outranks all others as a valuable asset to the fruit-grower. We are not able to propagate other insects in quantity, and introduce them to orchards at the proper time; but it is a very simple matter to carry in colonies of bees to insure a crop, if

the weather is fit for the bees to fly. Many orchardists realize this, and keep bees solely for the benefits derived from cross-fertilization of the fruit blossoms."

Mr. McIntyre at the California State Fruit-Growers' Association said: "A gentleman stated that he had a friend in this State who started into fruit-growing several years ago, locating thirty-five miles from any fruit-growing section, or where any bees were located. The first year that his trees blossomed, and in expectancy of at least some returns from his orchards, what should be the result but complete failure? He was advised to procure some bees to aid in the fertilization of the blossoms. He did so, and since then his orchard has been productive."

Mr. C. J. Berry, of Tulare County, California, whose fruit orchard contains over 400 acres, says: "Bees and fruit go together. I can't raise fruit without bees. Yes, sir'e. I have been all about my big orchard. Two years in succession I have put netting over some limbs of trees; and, while they blossomed all right, nary fruit; while on the same tree, where limbs were exposed to the aid of bees, plenty of fruit."

Dr. Fletcher, of the Ottawa Experiment Station, again says: "It will be found that not only are flowers absolutely necessary to bees, as the source of their food—nectar and pollen—but that bees and other

FIG. 56—BUCKWHEAT FLOWERS—SHOWING STIGMAS, POLLEN BASKETS AND NECTAR GLANDS

insects are no less necessary to most flowers, so that their perpetuation may be secured.

"This fact should be recognized by the fruit-grower above all others; for were it not for insects, and particularly for the honey bee, his crop of fruits would be far less than they are every year, and even in some cases he would get no fruit at all.

"Failure in the fruit crop is more often due, I think, to dull or damp weather at the time of blossoming, which prevents insects from working actively in the flowers, than to any other cause."

H. W. Collinwood, editor of the Rural New-Yorker, says: "We can easily forgive the bee his short working days when we consider the good he does. There is no question about the debt fruit-growers owe him. People talk about the wind and other insects in fertilizing our flowers; but I am confident that any man who will really take the time and pains to investigate for himself will see that the bee is nearly the whole story. I have seen the certain results of his good work in a neighbor's orchard. Those bees "broke the trees" down just as truly as though they had climbed on the trees by the million and pulled at them. The appearance of those trees after a few years of beekeeping would have convinced any fair-minded man that our little buzzing friends are true partners of the fruit-grower."

Thus we see that the interest of the beekeepers and of the fruit-growers are identical, and instead of clash between them there should be cooperation. They should live near one another or every orchardist should be a beekeeper or every beekeeper an orchardist. Dr. Phillips says in substance that it is a conservative estimate to claim that the honey bee does more good to agriculture in its office as a cross pollinator than it does as a honey gatherer. The estimated annual value of honey and wax in Tennessee is $250,000. With Dr. Phillips' statement that "the indirect benefits of the beekeeping industry add annually to the resources of the country considerably more than the amount received from the sale of honey and wax" we feel safe in placing the present value of the bees to the fruit-growers in Tennessee in the fertilization of the fruit blossoms at more than $400,000 annually. In the honey bee as pollinators of fruit and gatherers of honey and wax we have a combined valuation of approximately $1,000,000 annually.

In conclusion will say that the real value of the honey-bee has not been known, not realized and, of course, could not be appreciated. The possibilities of the beekeeping industry are great and in Tennessee alone can safely be placed at $2,000,000 annually. Education is needed. Ignorance alone stands in the way of progress along this agricultural line. An educational campaign is pleading for an opportunity which is made possible only by proper legislative enactments and the appointment of competent officials.

BEEKEEPING TERMS EXPLAINED

Absconding swarm—A swarm which leaves the hive and flies away.

After-swarm—Those swarming two or more times.

Alighting-board—Projecting board at hive entrance.

Apiarist—A beekeeper.

Apiary—A collection of beehives, colonies, etc.

Apiculture—Beekeeping.

Artificial swarm—A swarm made by dividing the colony of bees.

Bee-bread—The pollen of flowers gathered and deposited by bees in the comb.

Bee escape—A trap through which bees pass one way but not the other.

Bee-gum—A hollow log used as a hive.

Bee hive—A box or confine in which bees live.

Bee-moth—A medium-sized moth which deposits eggs in the comb, the young of which do considerable damage to the comb. Their presence indicates a weak colony.

Bee-paralysis—A disease of adult bees.

Bee-plants—Flowering plants which produce nectar accessible to bees.

Bee-space—From one-fourth to three-eighths of an inch.

Beeswax—A wax excreted from the lower side of the abdomen of the bee, the foundation for the comb.

Bee tree—A tree occupied by a colony of bees.

Bee veil—A thin covering for protecting the head.

Black bee—A variety of honey bee from Germany. It is black or dark brown in color. It is frequently called wild bee.

Bottom board—The floor of the hive.

Box hive—A plain box used as a bee hive.

Brood—Young bees still in the honey comb.

Brood-comb—Honeycomb in which the queen deposits eggs.

Brushed swarm—An artificial swarm of bees produced by the brushing part of the bees of a full colony into an empty hive—practiced to prevent swarming.

Candied honey—Honey which has crystalized.

Cappings—The wax coverings of cells.

Carniolan bee—A variety of honey bee supposed to have originated from Carniola, Austria.

Carton—A pasteboard box for holding comb honey.

Colony—A mass of bees comprising a swarm.

Comb—Six-sided cells made of beeswax, to hold honey or young bees.

Comb foundation—Beeswax which has been stamped into thin sheets to imitate honeycomb.

Comb honey—Honey and comb in natural condition.

Cyprian bee—A variety of honey bee supposed to have originated in the Island of Cyprus.

Danzenbaker brood frame—17 long, 7½ inches deep dividing the separation of a colony into two or more colonies.

Division-board—A partition used in the hive to reduce its size.

Drone—A male bee, the product of an unfertilized egg.

Entrance—An opening in a hive through which bees enter and leave.

Extracted honey—Honey separated from comb.

Extractor—A contrivance for throwing honey from uncapped combs.

Feeders—Devices for artificially feeding bees.

Foul brood—A bacterial brood disease, contagious.

Frame—Four small pieces of wood fastened together to hold the honeycomb.

Hive—Artificial quarters for bees.

Holy Land bees—A variety of honey bee supposed to have originated in Palestine.

Honey—Nectar of flowers gathered by bees and stored in comb.

Honeydew—A sweet substance produced by plant lice, certain scale insects, and plants.

Honey extractor—A device for throwing honey from combs.

Honey knife—A double-edged steel knife used in uncapping honey comb.

Hybrid—A bee crossed with the common black bee.

Italian bee—A honey bee which originated in the Italian region of Switzerland.

Italianizing—The method of changing a race of honey bees to an Italian variety, by means of introducing an Italian queen.

Langstroth frame—Dimensions, 17⅝ inches long by 9⅛ inches deep.

Langstroth hive—Any hive having frames hanging by shoulders with a bee space all around them.

Movable frame—A loose frame which can be taken from the hive.

Natural swarm—A swarm of bees with queen which leaves the old hive and seeks new quarters.

Nucleus—A small hive of bees consisting usually of three or four brood sections.

Nurse bee—A bee under 14 days old.

Observatory hive—A hive with glass sides which permits the observer to watch the bees at work.

Pickled brood—A contagious disease of bees which affects the brood.

Propolis—A glue-like substance collected by bees and used by them to fill up cracks and fasten together frames and sections in the hive.

Queen bee—A fertilized female produced from a fertlized egg, the larva of which is especially fed in an enlarged cell, known as the queen cell.

Queening—The introduction of a queen into a queenless colony of bees.

Queenless—A colony which has no queen.

Rendering wax—The act of melting combs and refining beeswax.

Ripe honey—Honey which has been evaporated by the bees and prepared for capping over.

Robbing—Bees entering other hives for the purpose of stealing honey.

Royal cell—The queen cell.

Royal jelly—A predigested food rich in carbonate secreted by bees and fed only to the larvae which are to become queens.

Shook swarm—An artificial swarm made by shaking bees from an overcrowded colony into a new hive, to avoid swarming.

Skep—A straw hive formerly used in rural sections.

Smoker—A device equipped with a bellows for producing smoke.

Solar wax extractor—A box containing a metal tray and a basin covered with a double glass frame, used for extracting beeswax by the heat of the sun.

Spent queen— queen bee which has become worthless.

Swarm—A division of a colony of bees into two for the purpose of increase. The old bees and old queen leave the hive.

Tested queen—A queen whose young show type characters.

Transferring—Taking bees and comb from a log or box gum and putting them into movable frame hives.

Unripe honey—Honey which has not been evaporated and treated with acid by the bees.

Worker bee—An undeveloped female bee the larva of which was not fed royal honey.

FIRMS HANDLING BEE SUPPLIES AND QUEENS

We frequently get requests for the names and addresses of firms dealing in bee supplies and queen bees. The following list has been prepared, and prospective beekeepers are advised to write for catalogues, to the different firms. Catalogues often contain suggestions which will be most helpful:

American Beekeeper, Berclair, Texas.
American Can Co., 112 W. Adams St., Chicago, Ill.
August Lotz & Co., Boyd, Wis.
Jas. W. Bain, Marion, Ohio.
W. W. Cary & Son, Lyonsville, Mass.
J. B. Case, Port Orange, Fla.
Dan G. Clark, 325-327 Broadway, Nashville, Tenn.
Francis J. Colahan, Bernardo, Calif.
Collingdale Apiaries, care J. R. Rambo, Collingdale, Pa.
J. H. M. Cook, 70 Cortlandt St. New York, N. Y.
W. W. Crim, Pekin, Ind.
Dadant & Sons, Hamilton, Ill.
John M. Davis, Spring Hill, Tenn.
Gus Dittmer, Augusta, Wis.
Doolittle & Clark, Borodino, N. Y.
W. T. Falconer Mfg. Co., Jamestown, N. Y.
E. T. Flanagan & Sons, Belleville, Ill.
Griggs Brothers, 521 Monroe St., Toledo, Ohio.
M. H. Hunt & Son, Bell Branch, Mich.
J. M. Jenkins, Wetumpka, Ala.

J. K. W. Shaw & Co., Loreauville, La.
Kretchmer Mfg. Co., 3rd St. and 11th Ave., Council Bluffs, Ia.
E. E. Lawrence, Doniphan, Mo.
W. H. Laws, Box 47, Beeville, Texas.
Leahy Mfg. Co., Higginsville, Mo.
G. B. Lewis & Co., Watertown, Wis.
W. T. Lewis, Lewisburg, Miss.
Chas. H. Lilly Co., Seattle, Wash.
F. A. Lockhart & Co., Lake George, N. Y.
L. A. Lowmaster & Sons, R. D. No. 5, Upper Sandusky, Ohio.
Malan Brothers, Luserna San Giovanni, Italy.
Marshfield Manufacturing Co., Marshfield, Wis.
Michigan White Clover Honey Co., Detroit, Mich.
Minnesota Bee Supply Co., Minneapolis, Minn.
Charles Mondeng, 160 Newton Ave. N. Minneapolis, Minn.
Mondeng Mfg. Co., 147-149 Cedar Lake Road, Minneapolis, Minn.
Fred W. Muth Co., 51 Walnut St., Cincinnati, Ohio.
National Can Co., Baltimore, Md.
The National Supply Co., 78 River St. Elgin, Ill.
New Century Rearing Co., Berclair, Texas.
Page and Lyon, New London, Wis.
Portland Seed Co., Portland, Oregon.
Walter S. Pouder, 513-515 Massachusetts Ave., Indianapolis, Ind.
A. I. Root Co., Medina, Ohio.
Roselawn Apiaries, Lincoln, Neb.
Otto Schwill & Co., 18-20 S. Front St., Memphis, Tenn.
C. M. Scott & Co., 1004 E. Washington St. Indianapolis, Ind.
W. D. Soper, Jackson, Mich.
I. J. Stringham, 105 Park Place, New York, N. Y.
Swarthmore Apiaries, Swarthmore, Pa.
The Victor Knolle Apiary Co., Hondo, Texas.
Curd Walker, R. F. D. No. 1, Jellico, Tenn.
C. H. W. Weber & Co., Central & Freeman Ave., Cincinnati, Ohio.
Noah D. West, Middleburg, N. Y.
White Mfg. Co., Blossom, Texas.
W. L. Womble, Raleigh, N. C.
The Wood Bee Hive Co., Lansing, Mich.
A. G. Woodman & Co., Grand Rapids, Mich.
Daniel Wurth, 1111 Smith St., San Antonia, Texas.
A. W. Yates, 3 Chapman St., Hartford, Conn.
York Honey & Bee Supply Co., 141 Ontario St., Chicago, Ill.

SUMMARY

That the climate and flora of Tennessee are adapted to beekeeping there is no doubt.

Italian bees kept in the old way produce an average of 39½ pounds of chunk honey per colony. Where modern methods and appliances are used the yields vary from 50 to 110 pounds.

Use the modern 10 frame hive. It is practically impossible to keep colonies strong in the log or box "gum."

Use full sheets of foundation in both the brood chamber and super, and thus conserve the energy of the bees and increase your honey yield.

Abandon the black or German bee. Increase your honey yield and facilitate your work and reduce your stings by keeping Italian bees.

Start beekeeping in a small way and increase your colonies as you become experienced.

Study your bees in connection with a reliable book or bee journal.

Control the bee moth by keeping your colonies strong.

Prevent loss from foul brood, and sacbrood by requesting an inspection of your bees.

Start with a pure-blooded Italian queen, purchased from a reliable queen breeder.

The chief sources of honey are from, first, the white clover; second, poplar or tulip tree; third, linden or basswood; fourth, sourwood; fifth, asters or stickweed; sixth, black locust, and, seventh, fruit bloom.

To produce the largest quantity of honey use modern extractor—carefully preserve frames of comb for refilling.

Use wax extractor and save all cappings or pieces of comb for beeswax.

Become a member of the State Beekeepers' Association and take advantage of the benefits of the organization.

NOTICE

The following bulletins have been issued by the Tennessee State Board of Entomology and available copies will be mailed to anyone writing for the same. Address State Entomologist and Plant Pathologist, Knoxville, Tenn.

Bulletin No. 1. Law creating the Tennessee State Board of Entomology—Rules and Regulations.
Bulletin No. 2. The Fumigation of Nursery Stock—Law and Amended Rules and Regulations.
Bulletin No. 3. The Control of Insects, Fungi and Other Pests.
Bulletin No. 4. The San Jose and Other Injurious Scale Insects of Tennessee, with Methods for Their Control.
Bulletin No. 5. Orchard Management in Tennessee.
Bulletin No. 6, Vol. 1, No. 2. Amended Law Creating the Tennessee State Board of Entomology—Amended Rules and Regulations. Apiary Inspection Law.
Bulletin No. 7, Vol. 1, No. 3. The Inspection and Transportation of Nursery Stock in Tennessee, Other States and Canada.
Bulletin No. 8, Vol. 2, No. 1. The San Jose Scale in Tennessee with Methods for its Control.
Bulletin No. 9, Vol. 2, No. 2. Beekeeping in Tennessee.
Bulletin No. 10, Vol. 2, No. 3. Suggestion on Preparation and Use of Spray Formulas.

First Annual Report of the State Entomologist and Plant Pathologist, 1905.
Second Annual Report, 1906.
Third Annual Report, 1907.
Fourth Annual Report, 1908.
Fifth Annual Report, 1909.
Sixth Annual Report, 1910.
Seventh Annual Report, 1911, Vol. 1, No. 1.
Eighth Annual Report, 1912, Vol. 1, No. 4.

SUGGESTIONS ON MAILING SPECIMENS

Questions pertaining to insects and plant diseases will be gladly answered. All requests should be accompanied by specimens. These should be sent, not in a letter, but in a tight tin or wooden box with no openings, addressed to the State Board of Entomology, University of Tennessee, Knoxville, Tenn. If possible, send some of the food of the insects, together with their work. Wrap all neatly, placing your own name upon the package. In a letter tell all you have noticed about the insect, as to its food, its first appearance, abundance, extent of injury, etc.

A collection of Tennessee insects is being made, and any assistance in adding to this collection will be greatly appreciated.

Cornell University Library

Beekeeping in Tennessee,

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